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ELECTRICAL REVIEW

FOUNDED 1872

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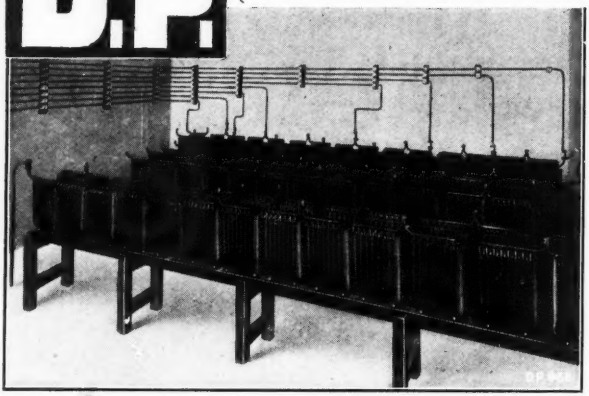

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ELECTRICAL REVIEW

Volume CXXX **No. 3360**

Friday, April 17, 1942

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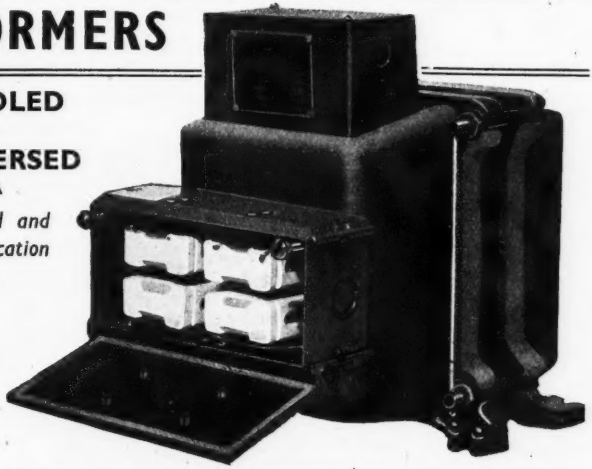

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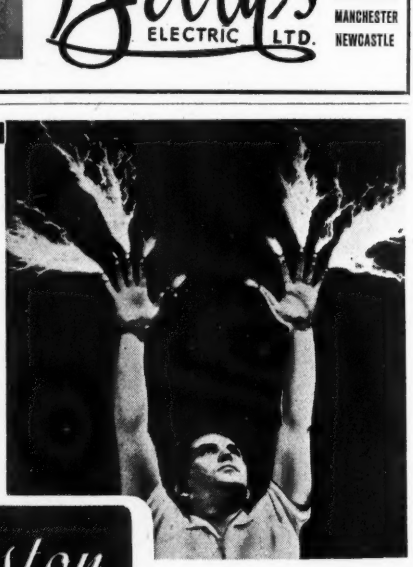

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THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

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Mercury-Vapour Plant

Economising Fuel Resources

REMARKABLE overall thermal efficiencies have recently been achieved by the latest power plant in the United States to operate on the binary-fluid cycle. The results reported as obtained at Kearney generating station during the past eighteen months are substantially better than would be possible with any commercial steam plant working between the same temperature limits and it is claimed by the engineers responsible for its development that the Emmett cycle offers considerable possibilities in the way of economising natural fuel resources. In regard to reliability, the 50,000-kW combination (20,000 kW mercury and 30,000 kW steam) has operated satisfactorily for 83.6 per cent. of the period, and the chief troubles, mainly due to tube deposits in the boiler, appear to have been overcome.

Experimental Stage Passed

It was only with the commissioning of the Kearney plant, some two years ago, that the cycle could be said to have passed beyond the purely experimental stage and to have entered the field as a possible alternative to steam power. No doubt for this reason and also because of the considerable practical difficulties which were known to have been encountered initially, little attention has hitherto been paid in Great Britain to this method of generating electricity. On the other hand much that has been written on the subject over here seems generally to have been unduly optimistic. The thermo-dynamic principles and the inherent advantages of the binary-fluid cycle are discussed in an article in this issue.

Although fuel consumption per unit of output is a very considerable item in the cost of generation, a high thermal efficiency does not necessarily imply a corresponding low overall cost of production. In steam plant a high thermal efficiency may be attained only by the adoption of an advanced design and a large operating temperature range, which materially affect capital and running charges. In the design of a steam plant to meet any particular loading conditions there is an optimum thermal efficiency beyond which it does not pay to go.

Capital and Fuel Charges

Of late years there has been a marked and steady tendency towards higher thermal efficiencies on economic grounds. The higher capital charges thereby incurred are justified, first, by the steady increase in the cost of coal and, secondly, by the higher load factors at which, since the advent of the grid, a base-load station can be operated. Load factor exercises a very great influence upon economic efficiency, whereas its precise effect upon thermal efficiency is less readily determined.

As a result of this tendency steam plant has now reached so high a state of development that any major advance from some of the latest designs must wait upon the ability of the metallurgist to provide suitable constructional materials that are capable of withstanding for a reasonable time the more severe operating conditions

which still further development will entail. The Emmett cycle is properly to be considered as a logical development of the steam cycle, its inherent advantages lying in the minimising of certain unwelcome phenomena which in the more advanced designs of steam plant attain to serious proportions and in fact constitute a barrier to further progress. In view of the possible maintenance of high fuel prices for many years, the question of the suitability of the binary-fluid cycle for the generation of electricity under certain conditions appears to warrant serious consideration.

Domestic Appliance Business

NONDESCRIPT fires and boiling plates were a common feature of certain department stores and other establishments before the war, although it was always possible to obtain sounder appliances of reputable makes. Now, however, the latter are scarce and yet the other sort seem to be in fairly good supply. This phenomenon has brought into the electrical retailing field a number of concerns which did very little business of this kind before and some of these seem better able to obtain standard lines than really legitimate electrical retailers. The whole matter is under observation. For instance, the Electricity Commissioners have asked the Board of Trade if it can exercise a stricter control upon materials for electrical appliances, and at the retail end the Electrical Fair Trading Council has suggested that manufacturers should see that established electrical retailers are served before newcomers to the business.

American Working Hours

UNITED STATES labour has hitherto enjoyed a 40-hour working week—a measure of the social advance made by a highly mechanised state. Now, under the pressure of war conditions, there is a move for its suspension as it is considered a handicap to munitions production. The two great labour organisations are willing and, indeed, have pressed industrialists to run their plants for 24 hours a day, seven days a week. They have agreed to give up the double payment for Sundays and holidays, but wish to retain time and a half payment for all hours worked in excess of forty per week. It may be contended that costs will be higher if this is conceded, but that is a secondary consideration if there is a substantial increase in production. The risk to be guarded against, as has been found in this country, is overstrain and consequential decline in quantity and quality of work.

Leisure Hours

ALTHOUGH only a certain number of hours a day can fruitfully be spent on the same work, the recreation brought by a change of occupation can be made potentially useful. Many examples are given by Mr. H. Cobden Turner in his chairman's address to the N.W. Centre (now available in the I.E.E. *Journal*) of the way in which the electrical engineer may "aid the community in the sphere for which he is best fitted." Thinking on these things provides refreshment from the concentrated attention given to the grim realities of the moment, while discussions at the local Centres, made effective through the channel provided by the I.E.E. Post-War Planning Committee, should also be an education in the wider implications of engineering.

Strained Eyes

IN a letter to the editor of the *Daily Telegraph*, an optician refers to complaints from factory operatives regarding the ill effects of working all day by electric light. This statement needs qualification in order to avoid misunderstanding. There is no evidence, according to the Fifth Departmental Report on Lighting in Factories, that prolonged working by artificial light is harmful to the eyes, provided there is sufficiency of lumens and freedom from glare. When these conditions are not fulfilled (and there is now statutory authority to ensure that they shall be) then we agree with the writer of the letter that the effect on output is likely to be considerable.

Candidates for Training

IT comes as a surprise to hear from the Select Committee on National Expenditure that the selection of candidates for Government engineering training schemes has involved so little consideration of suitability. Surely that is the first essential for success. A sample investigation showed that 20 per cent of the candidates did not stay the course or were rejected as unsuitable. It is to be hoped that the Committee's suggestions for more rigorous pre-examination will be followed.

The Binary-fluid Cycle

Utilising the Inherent Advantages of Mercury-vapour and Steam for Securing Higher Thermal Efficiences

By W. A. Webster,
Grad.I.E.E.

A PROPER appreciation of the advantages offered by the Emmett cycle entails a review of some of the factors which limit the possible development of the steam power plant. Plant-item efficiencies can be ignored, since we are concerned chiefly with thermodynamic principles and because this and allied problems have a comparable bearing upon all external-combustion turbine plants.

An understanding of the major principles involved is most easily approached by way of the temperature-entropy diagram; we may assume, for the purpose of argument, that any heat drop considered will be adiabatic.

The basic steam cycles with their Carnot equivalents are shown in fig. 1. Whatever the working substance, the area of the Carnot diagram is arbitrary, since governing would be effected by variation of the state indicated at point B with respect to entropy. The areas shown represent the maximum outputs possible with water. The diagrams are drawn for an initial steam pressure of 200 lb. per sq. in. gauge and an exhaust pressure of .49 lb. per sq. in. abs.—limits which would be unsatisfactory in practice as well as inefficient.

For a given operating temperature range the Carnot cycle represents the maximum overall thermal efficiency attainable. It is, of course, a purely hypothetical ideal and the aim of the designer, whatever the cycle he has adopted, is that the theta-phi diagram of his plant shall approach as closely as possible to that of the corresponding Carnot cycle.

The value of the θ–ϕ diagram in this examination is that it represents in graphical form the work done per pound of working substance in the particular cycle under consideration.

In any heat-engine cycle there must be four basic operations:—(a) heat release, (b) heat transference, (c) heat conversion and (d) heat rejection. Of these we may here ignore (a), and we have agreed that (c) shall be considered as being adiabatic, so we may also ignore that as conforming to the ideal case. Since (d) would not be practicable in large installations but for the surface condenser, we may ignore this also as by its nature conforming to the ideal case. We are therefore left with the phenomenon of heat transference, which is the crux of the problem.

In the ideal cycle it is postulated that heat shall only be given or transferred to the working substance from the furnace at the higher operating temperature limit T_1, and only rejected by it to the condenser at the lower limit T_2—that is, these operations must be isothermal. In fig. 1(b) the heat taken in at absolute temperature T_1 will be represented to scale by the area included between the T_1 isothermal and the entropy axis—that is, by the area NABP. Similarly, the heat rejected at T_2 will be represented to scale by the area ND′CP. The work done during the cycle per pound of working substance is then the difference between the heat taken in and the heat rejected—that is, to scale, area

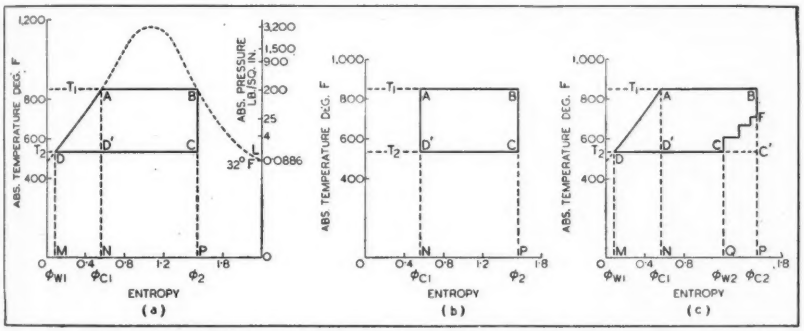


Fig. 1.—(a) The simple Rankine cycle using water, showing the liquid and saturation lines DA and LB continued to the critical point. (b) The Carnot cycle, using water, equivalent to (a). (c) Showing the effect which bled-steam feed-heating would have upon the Rankine cycle, giving DABFC. The Carnot equivalent remains the same at D′ABC′

D'ABC. In other words, we may say that the area included in the $\theta-\phi$ diagram by the state points, which define the condition of the working substance during the complete prosecution of the cycle, will represent to scale the work done per pound of working substance during that cycle. In this respect, the isothermals AB and CD' and the isentropics D'A and BC, fig. 1 (b), are each to be considered as composed of an infinite number of state points.

Thus, the rectangular $\theta-\phi$ diagram of the Carnot cycle represents the maximum possible amount of effective work available between the temperature limits T_1 and T_2 and entropy limits ϕ_1 and ϕ_2, whatever these limits may be, and therefore also represents the maximum possible overall thermal efficiency.

We may apply this principle to the $\theta-\phi$ diagram of the Rankine cycle, fig. 1(a), *provided* that the working expansion is considered to be adiabatic. Since heat is taken in along the water line DA—that is, between T_2 and T_1—the efficiency of the cycle $= \frac{\text{area DABC}}{\text{area MDABP}}$ will be less than the efficiency of the corresponding Carnot cycle $= \frac{\text{area D'ABC,}}{\text{area NABP}}$ although more work will be done per pound over the Rankine than over the Carnot cycle (*i.e.* area DAD' = increase in work done is less than area MDD'N = increase in heat rejected.)

The ratio $\frac{\text{area DABC}}{\text{area MDABP}}$ (fig. 1(a)) is the basic efficiency of the cycle and the ratio of this efficiency to the corresponding Carnot efficiency will provide a "yardstick" by which we can measure the extent to which the designer has applied the principles of the ideal cycle. The greater the value of this ratio, which we may call the *comparative efficiency*, the better the use which the designer has made of the operating temperature range, since the Carnot efficiency will be given by the expression $\frac{T_1-T_2}{T_1}$. In the case of the Rankine cycle, the comparative efficiency will be less than 100 per cent. because the $\theta-\phi$ diagram is non-rectangular.

For many reasons, superheated steam is preferable to saturated steam for use in prime movers and the Rankine cycle developed automatically into the straight regenerative cycle (fig. 2). The optimum pressure for the temperature limits shown is about 1,400 lb. per sq. in. abs., giving the cycle DASBC. For a given temperature range, the less the initial pressure the greater the initial total heat but the less the available heat drop, except at about the critical point. These apparent anomalies are due to the non-linear variation of latent heat with saturation temperature. There is no equivalent Carnot cycle using water, but for a perfect gas it would be of the form D'A'BC, of constant height BC but arbitrary area as in fig. 1. Incidentally the value of superheat from the standpoint of thermal efficiency was not understood for many years after its use had become general and some of the arguments put forward in those early days make interesting reading.

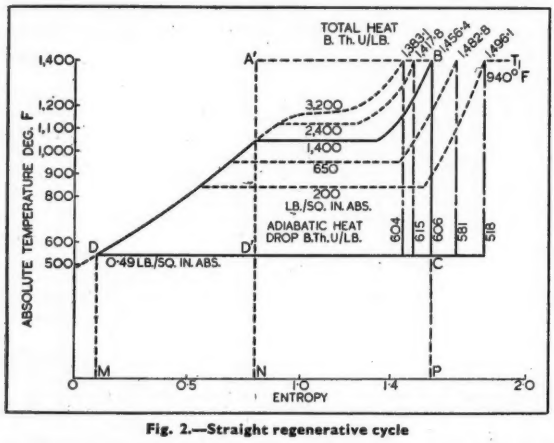


Fig. 2.—Straight regenerative cycle

Now, the choice of boiler pressure and final steam temperature may vary within wide limits, but in practice the relation between the two will always be such that the heat rejection per pound will—broadly speaking—be the same for any one steam power plant as for any other, for the value of this heat quantity will be the heat content per pound at the turbine exhaust (neglecting the sensible heat per pound in the hotwell) and this is determined by the exhaust pressure (standardised at 0·49 lb. per sq. in. abs.) and exhaust dryness fraction (standardised at 0·87). The heat rejection per pound will then always be in the region of 912 BThU. (The present writer has dealt elsewhere in greater detail with the steam cycle.*)

In other words, the area MDCP (fig. 2) will be approximately the same for all steam cycles. It follows that the greater the area

* "The Working Substance" E.P.E.A. Technical Publications, 102, St. George's Square, London, S.W.1. Price 1s. 2d.

of the entropy diagram which the designer can erect upon this rectangle, the greater the efficiency of the resulting cycle.

Now we can see from the entropy diagram more clearly than in any other way that if water is used as the working substance, the maximum benefit of the temperature range employed, possible with water, will not be realised by adopting a low pressure and a large amount of superheat (fig. 2). It is theoretically far preferable to have the saturation temperature as high as possible and to use only enough superheat to ensure that the exhaust dryness fraction shall not fall below 0·87 (the minimum permissible figure if blade erosion is to be avoided, though probably in the near future the development of precautionary measures will permit of a figure of 0·86). It is for this reason that steam pressures have of late years shown so marked a tendency to rise.

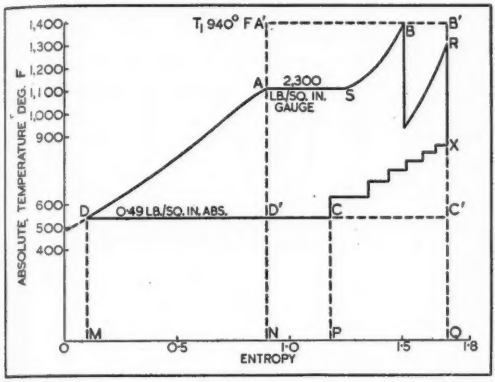


Fig. 3.—Reheat cycle, steam-bled at six stages

The designer is, however, severely handicapped by the nature of the constructional materials available. Even the finest alloy steels, developed after many years of intensive research, undergo a substantial deformation when subjected to stress at high temperatures and if this deformation or plastic creep is not to exceed such a rate as will permit of a reasonable plant life, the final steam temperature must not exceed some 1,000 deg. F. where very high boiler pressures are used. The final steam temperature will not in practice exceed some 930 to 950 deg. F., and this limits the boiler pressure for the straight regenerative cycle to some 1,400 lb. per sq. in. A higher boiler pressure may be used by adopting the reheat cycle. From fig. 3 it is seen that the area of the entropy diagram and, therefore, the basic efficiency, is substantially increased. This relates to the reheat cycle with six-stage bled-steam feed-heating, as applied at the Twin Branch station in the U.S.A. which is now claimed as the most efficient steam power station in the world. As with the straight regenerative cycle, there is no equivalent Carnot cycle using water, but with a perfect gas it would be of the form D'A'B'C', of constant height but arbitrary area.

Fig. 4 shows to the same scale the relative advantages and disadvantages of mercury and water. The data for mercury was taken from the Mercury Tables compiled by Dr. Kearton, and published in 1923. The formulæ used were empirical and the authorities seem to agree that the tables are reliable up to the limit shown of 1,000 deg. F., beyond which they do not go. Data on the properties of mercury above this temperature is lacking, but it seems very probable that the critical temperature is in the region of 1,800 deg. F., and that the critical pressure is found to be somewhat higher than 2,700 lb. per sq. in.

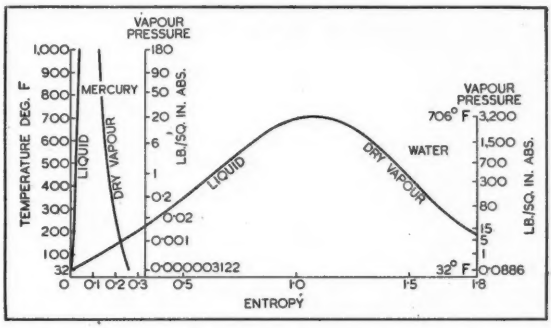


Fig. 4.—Characteristics of mercury and water

The great disadvantage of water as the working substance is now plain. It is that the vapour pressure rises so rapidly with the saturation temperature. The disadvantage is two-fold: first, because of creep and secondly because it renders the design of efficient blade systems very difficult, increasing the losses due to windage, gland leakage and

tip-clearance leakage and offering a less favourable ratio of blade speed to steam speed.

A second disadvantage of water is that the liquid entropy line (DA, fig. 1a) lies well away from the vertical. Although each increment of boiler pressure, with its associated increase in final steam temperature, results in an increase in the area of the entropy diagram and therefore in the basic efficiency of the cycle, it results at the same time, by the orientation of the state points during heat transference, in a decrease in what we have termed the comparative efficiency (see fig. 2). In other words, the greater the heat drop which the designer achieves by the steam cycle, the more wastefully is he using the operating temperature range and the further away is he getting from the ideal rectangular diagram, entirely because of the objectionable characteristics of the working substance.

There is, then, a wide field of application for a working substance, suitable for use in heat engines, which while fulfilling the necessary requirements of fluidity, cheapness, safety, and so on shall at the same time have a vapour pressure at high temperatures very much less than that of water and an entropy diagram very much nearer the ideal rectangular form.

Various substances have been proposed in this connection, but the only one offering the desired advantages over water, while being suitable in other respects, is mercury, and even this is only partly true.

A particular development in steam power technology, for which a wide field of application was not envisaged when experimental work was started on the binary-fluid cycle, has to some extent lessened the disadvantage imposed by the nature of the liquid entropy line for water. The pressure-compounding of turbine stages has permitted the employment of bled-steam feed-heating (figs. 1c and 3). This would, in the limiting case, achieve the aim of the Carnot cycle that a certain amount of energy shall always be retained in the system, but in a different way from that laid down by Carnot. If, for the purposes of argument, we apply the system to the Rankine cycle (fig. 1c), the resulting entropy diagram may be made to approach in area very closely to that of the Carnot equivalent and in the limiting case the comparative efficiency would be 100 per cent. The work done per pound is less and therefore the steam flow for a given output will be greater, than for straight expansion, but this increase is proportionately less than the corresponding decrease in heat rejection per pound (*i.e.* fig. 3, area CXC^1 is less than area $PCC'Q$). The system is of only limited application, but if properly applied it certainly does detract to some extent from the superiority of mercury over water in the one respect of the liquid entropy line.

Referring the water line DA in fig. 1a to the ideal case, we have seen that it would then be vertical. In other words the constant-pressure lines AB and CD would be of equal length and the ratio $\frac{AB}{CD}$ would have its maximum value of unity, whatever the limits chosen.

Now $AB = \frac{L_1}{T_1}$, where L_1 = latent heat of vaporisation at absolute temperature T_1, and $CD = \left[\frac{L_1}{T_1} + \int_{T_2}^{T_1} \frac{C\,dT}{T}\right]$, where C is the specific heat, which may be expected to vary slightly with temperature; this variation is, however, so slight as to be negligible and we may take C as constant. We then have:

$$CD = \left[\frac{L_1}{T_1} + C\int_{T_2}^{T_1} \frac{dT}{T}\right] = \frac{L_1}{T_1} + C\log_e\frac{T_1}{T_2}, \text{ and}$$

$$\frac{AB}{CD} = \frac{\frac{L_1}{T_1}}{\frac{L_1}{T_1} + C\log_e\frac{T_1}{T_2}} = \frac{1}{1 + \frac{C\log_e\frac{T_1}{T_2}}{\frac{L_1}{T_1}}}, \text{ the accuracy}$$

of this expression being only very slightly affected by our assumption of constant specific heat between T_2 and T_1.

We may therefore say in general that a minimum value of $\frac{C}{L}$, or, to avoid cumbersome decimals, a maximum value of $\frac{L}{C}$, between T_2 and T_1 will give a maximum value of AB/CD and that the variation in the value of this ratio between T_2 and T_1 should be as small as possible. A comparative tabulation of values of this ratio for various substances provides a ready means of investigating the nature of their liquid entropy lines without having to plot them from entropy tables; for this purpose, however, C cannot be taken as constant.

Temp. Deg. F.	Mercury			Water		
	L	C	L/C	L	C	L/C
32	132·97	·0335	3970	1075·4	1·009	1066
100	132·31	·0332	3990	1037·1	0·9967	1040
200	131·34	·0329	4000	978·3	1·0039	974·3
300	130·37	·0328	3980	910·5	1·029	884·9
400	129·41	·0329	3940	827·0	1·064	777·1
500	128·44	·0332	3870	714·5	1·112	642·5
600	127·47	·0335	3810	549·0	1·172	468·4
700	126·58	·0338	3750	—	—	—
800	125·94	·0341	3690	—	—	—
900	125·29	·0345	3640	—	—	—
1000	124·65	·0347	3600	—	—	—

The table shows the immense superiority of mercury in this respect and the point is brought out graphically in fig. 4.

Mercury has, however, one characteristic which effectively precludes its use as the sole working substance in heat engines. The vapour pressure falls very rapidly with the saturation temperature (fig. 4). It is so low at even moderate temperatures that to attempt to extract energy from the vapour by turbine blading would at these temperatures be impracticable.

The particular properties of mercury, therefore, render it suitable for use in the higher regions of the temperature range, while in the lower regions it must give place to water, which may, for a moderate operating temperature range, be made (by the adoption of bled-steam feed heating) the basis of a cycle of fairly high comparative efficiency. Thus we arrive at the fundamental conception of the binary-fluid cycle, which utilises the inherent advantages of both substances.

The broad principle underlying the design of such a plant is shortly this—that the heat energy released in the furnace by combustion shall be transferred, not to water as in the steam power plant but to mercury. A certain heat drop will then be achieved by turbine blading in the normal way. As the total heat per pound at exhaust from the mercury-vapour turbine will be comparatively very high, it will not be rejected to waste as in the steam power plant, but to water forming the working substance in a secondary cycle, which except for the boiler will be a steam power plant of normal design. The boiler will be the mercury condenser and evaporation and superheating of the water will be achieved by the exhaust heat of the mercury vapour.

The term " by-product power " has been applied by some writers to the output of the steam component. This is to be deprecated since it is fundamental to the binary cycle that the heat drop is achieved in two steps, of which the steam component forms the second stage. In the most successful example of the combination in operation—at Kearney generating station, New Jersey—the total output of the unit is 50,000 kW, the mercury-vapour turbine being rated at 20,000 kW and the steam turbine at 30,000 kW.

One feature of the cycle should be pointed out here. The available heat drop per pound of mercury (fig. 4) is for given temperature limits very much smaller than it would be for water (*i.e.*, the actual area of the entropy diagram for mercury is very small). This simply means that for equivalent outputs the mass rate of flow through the mercury-vapour turbine would be many times greater than through a steam turbine, though due to the high density of mercury the two turbine frames would be of comparable size. In other words, for each entropy diagram for water, the diagram for the primary cycle would, so to speak, be repeated perhaps eight or nine times.

American Metal Production

DURING the past year one electrical manufacturer alone contracted to supply transformers and control gear for 25 arc furnaces for melting steel, of a capacity exceeding 160,000 kVA. In addition it furnished equipment totalling nearly 60,000 kVA for 17 ferro-alloy furnaces. Some idea of the way in which arc furnaces are growing in favour for manufacturing alloy steel of high grades is conveyed by the fact that in one plant alone there are in operation, or under construction, 16 such furnaces with an associated transformer capacity of 150,000 kVA that are capable of producing in the neighbourhood of a million tons of alloy steel per year.

Brass and copper producing concerns are installing new mills for rolling the metal needed for making cartridge cases and other military uses. Individually the motors that drive them are of moderate sizes, but in the aggregate they constitute a large increase of production capacity. One electrical manufacturer supplied driving equipments for 19 such mills totalling 16,000 HP for installation in six different plants.

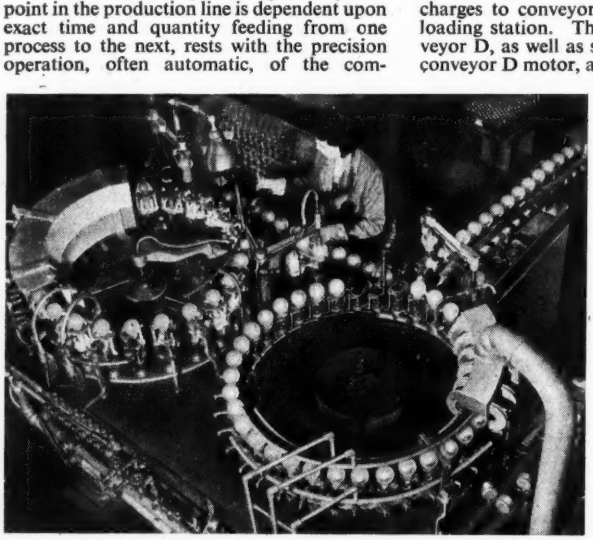
Information of this kind contained in a recent statement by Mr. A. F. Kenyon (steel mill engineer, Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pennsylvania) revealed improvements introduced into rolling mills recently modernised, or newly built. Power for operating a Cleveland mill rolling light-gauge tin-plate strip is furnished by a four-machine 300-RPM motor-generator set that is claimed to be of the largest capacity ever used for such service. It is made up of two main generators, each of 4,000 kW at 750 V, with a 300-kW reel booster generator, driven by a three-phase synchronous motor of 11,250 HP at 11,000 V, together weighing more than 175 tons. Another four-stand mill rolling heavier gauge material in Southern Ohio is provided with a main motor-generator set of 7,000 kW as well as an auxiliary nine-machine set of 600 HP at 440 V.

Southern plant of the single-stand four-high type that was being built to roll plate 140 in. wide for shipbuilding and similar purposes is to be driven by a DC 35–70 RPM motor of 7,000 HP at 700 V. Its maximum emergency torque capacity of 2,890,000 lb.-ft. makes it one of the largest reversing motors ever built with a single armature. Energy is furnished by a motor-generator set of 6,000 HP at 6,600 V assisted by a 154,000 lb. steel plate fly-wheel. During the year two large mills placed in service for rolling aluminium plate were each equipped with a DC driving motor of 5,000 HP at 525 V. Due to their very low speed of 30 to 60 RPM the torque capacity of these reversing motors is extremely large making them physically of great size. New mills in the non-ferrous metal industries are being installed on a scale that is said to rival steel rolling mills.

Handling Materials—III

Sequence Operations

BEYOND doubt the success of many continuous-flow systems of production, where efficient processing at any one point in the production line is dependent upon exact time and quantity feeding from one process to the next, rests with the precision operation, often automatic, of the components of the handling system in the correct order of sequence. It would have been quite impossible to establish many present mass-production schemes, with their numerous interdependent and interlinked processes, without an ordered system of conveyance control. To appreciate this one need think only of the finishing machines in electric-lamp production in which the rotating assembly units, which are really special conveyor systems are served by accurately timed conveyors on which the various glass and wire components are assembled and fixed with most exact timing.



Present-day mass production schemes demand an ordered system of conveyance control; the finishing group of machines in lamp production

The nearer we approach precision operation the greater becomes the need for automatic control, for this is what is implied usually by the general term "sequence control" and it is inherently electrical control.

To create the correct perspective for the electrical reader and to avoid repetition when referring to various applications, it is well to outline an electrical system, and to this end we give the following notes which relate to the scheme of Mavor & Coulson, Ltd., for four conveyors. Referring to the diagram on the next page Conveyors A and B deliver towards one another on to conveyor C which discharges to conveyor D for transport to the loading station. The control panel for conveyor D, as well as starting and stopping the conveyor D motor, also controls the A, B and C conveyor motors in such a way that the supply is not available to any of them until conveyor D is running. When the panel D is operated a time relay automatically closes the panel contactor after a predetermined time interval, usually 3 to 15 sec., and the closing of this contactor starts up conveyor C and at the same time completes the supply circuit to panels A and B which also are provided with timing relays operating corresponding contactors.

As conveyors A and B are not arranged in tandem they can be started together and do not require sequence control. Either of these conveyors can be cut out by operating its isolating switch.

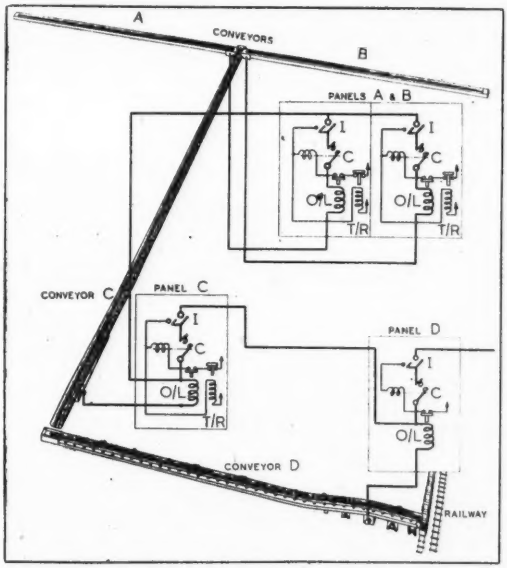
If conveyor C is stopped in any way conveyors A and B will also stop and, similarly, if conveyor D is stopped conveyors A, B and C will operate in sympathy. It will be seen that the sequence starting and stopping are straightforward, automatic, interlocked and, above all, simple, and an important result is that flooding at the transfer points is avoided. All the conveyors are controlled from the loading point, but it is also possible to stop them at the driving positions.

Many variants are possible with this basic scheme. For example, by omitting the timing relays from conveyors A and B and adding stop-start push-buttons, these conveyors can be started only from the driving points, although they can be stopped also at the loading point. Further, means can be provided for running conveyors A and B for testing without the others.

The following applications relate to a few

installations for the electrical equipment of which the Metropolitan Vickers Electrical Co., Ltd., was responsible. A large grain warehouse with seven floors and a basement has an installation of 14 basement conveyors and 17 top-floor conveyors, in addition to five internal and two external elevators.

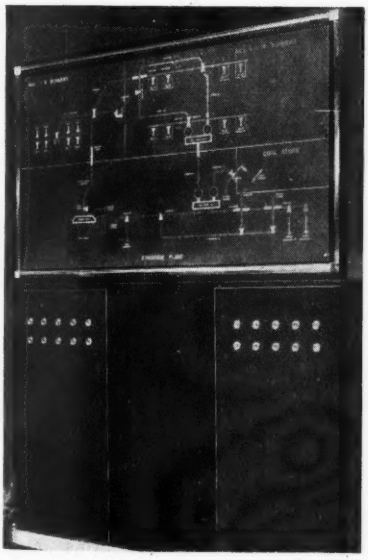
These separate entities can be operated in any combination for the various requirements in loading, distributing and discharging grain, with the intermediate services such as cleaning and weighing. Other machines incidental to the duties are a skip elevator motor, two winch motors and 12 hoist-winch motors. Apart from these last-named incidentals there are 37 motors fully sequenced in adjustable combinations, in spite of their being controlled by hand-operated starters. The dispositions are such that in the event of any conveyor tripping or being stopped by an emergency switch, all the preceding conveyors on the sequence are switched off to prevent the accumulation of grain. The control equipment consists of the company's standard units with appropriate interlocking provisions.



A system of sequence control involving four conveyors

An interesting installation for coal handling at a power station consists of a system of conveyors operating between three wagon tipplers, an unloading point on the road, the coal pile, and two boiler houses. The conveyors are interlocked for any coal disposal arrangement desired, the motors being controlled by hand-operated slip-ring starters, each with auxiliary contacts, for interlocking from the master controller *via* the preceding starter in the sequence. The conveyors can be started up only in the pre-selected sequence and the stoppage of any one conveyor will cause all those earlier in the sequence to stop. An illuminated mimic diagram indicating the actual flow of material on such a conveyor system is of great value to the management staff.

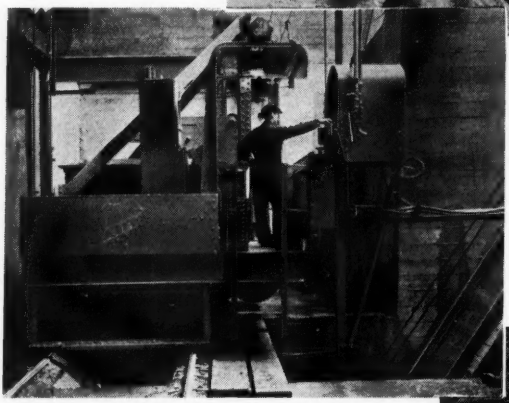
An installation for a blast furnace charging plant handles up to 3,500 tons of raw material per day, and from the bunkers to the hoist the whole is under the control of one operator only on a scale car. The hoist distribution and charging operations are controlled automatically without attendance. On reaching the control station at the bottom of the hoist the operator of scale-car manipulates push-buttons



An illuminated mimic diagram indicating the actual flow of material on a conveyor system is of great value to the management staff

for the remainder of the process according to requirements, and the automatic control gear looks after the rest. The operator actuates the compressed-air opening of the hopper into the skip, at the same time noting the position of the charge levels in the furnaces from which he decides on the next distribution. On pressing the chosen push-button the following sequence is set in motion automatically: hoist starting, controlling

Some excellent group sequence drives are a feature of a new gravel-handling installation

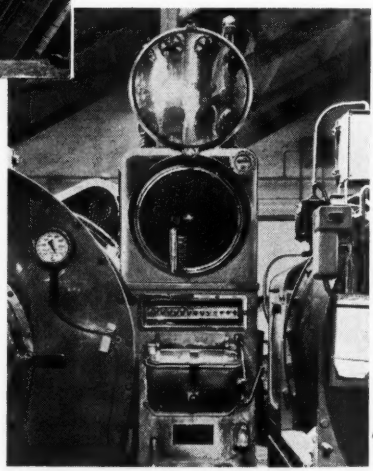


The operator on the blast-furnace charging plant scale car manipulates push-buttons at the control station

and stopping, tipping the skips, moving the distributor, operation of the auxiliary and main belts, removal and replacement of the measuring rod before and after charging, and the operation of the distribution and charge-level indicators. Meanwhile he returns with the scale car for the next filling from the bunkers.

Sequence control in the fullest sense implies complete automatic operation throughout the installation or section concerned, with probably one initial remote supervisory control function. Many instances do not call for such complete automatic control however, although a part measure of sequence control is essential, usually to prevent the banking-up of material on a process line, which is becoming known as sequence interlocking or interlinking.

An installation at a tarmacadam works involves such a scheme of electrical interlocking designed to prevent the banking-up of blast-furnace slag in the various stages of production on a sequence-process line. The significance of this scheme of interlocking rests largely on the fact that practically every component of the production plant, which is operated essentially on the continuous-flow principle, is individually driven. In order to provide the necessary interlocking for so many individual drives in an essentially continuous-flow plant without complete automatic control, all the motor starters



Automatic control of the feeding of the washing materials and solutions to washing machines is a feature of a new laundry installation

are contained in a switch house in which are also situated the main oil switch, busbar

chamber, and so on. The sequence of operation is such that it is necessary in the event of the breakdown of one motor to stop other motors on the plant, so that material will not build up on the line before the point of breakdown. Further, it is at times convenient to interlock the motors for short periods. The general lay-out arrangement, then, is such that any one motor on the plant can be conveniently and readily electrically interlocked with any other motor from the central control station.

Some excellent group sequence drives are a feature of a new gravel-handling installation in Derbyshire. From the electrical viewpoint we noted especially the simplicity of the electric drives, particularly in their outstanding contribution to the great flexibility of operation of the plant as a whole, and to the practically automatic running of the system by virtue of remote control of all the motors from a central control station, all of which is bound closely with the sequence operations involved. Interlinking the main operations of washing, grading and crushing there is an extensive system of conveying, and the essential continuous-flow principle in the design of the complete system has resulted in some notable examples of group driving by means of which sequence operations are effected in very simple but very efficient manner.

The installation was designed for an input capacity of 40 tons per hour, and many improvements, particularly with regard to remote electrical control, are responsible for greater efficiency of operation. The control board, a very sound and neat equipment by George Ellison, Ltd., consists essentially of a metal-clad busbar chamber on the front of which is mounted a line of oil circuit-breakers, one for each motor. All motors of up to 5 HP are started direct-on by the oil circuit-breakers, while the larger motors have rotor resistance control in the form of drum-type starters.

Automatic control of the feeding of the washing materials and solutions to the washing machines is a feature of a new laundry installation. A small 25-V Klaxon motor drives an insulated disc in which there are slots through which electrical contacts are made between fingers at the front and a copper plate at the back of the disc. The contact operates solenoids which, in turn, open needle valves by which compressed air is supplied to the valves governing the supply of washing solutions to the machine. The supplies of soap, soda, blue, hot and cold water, steam, and the outlet are all controlled in this way. As soon as a solution magnet is energised the motor driving the disc stops and the disc drive is taken up by a water meter through an ingenious free-wheeling arrangement. The amounts of the various materials supplied to the machine are regulated by the lengths of the disc slots, *i.e.*, the time of the electrical contacts, and the slots on the disc are made according to a formula set up by chemists. Each formula (one disc) is designed for a definite amount of washing.

Counting Dust Particles

THE control of industrial dust and means of estimating the degree of protection required, for which purpose a large number of instruments are available, are discussed in an article by Mr. K. L. Goodall, one of H.M. engineering inspectors of factories, in an article published in the March *Journal of Scientific Instruments*. Among the instruments devised for measuring air-borne dust concentrations and comparing particle-size distributions the thermal precipitator (C. F. Casella & Co., Ltd.) is rapidly becoming standardised in this country. The dust-laden air sample is drawn between two thin microscope cover glasses, part of whose surfaces lies in the dust-free space of an electrically heated wire so that the dust content of the sample under inspection is completely deposited on the glasses.

In the case of the electrostatic sampler (U.S.A. Mine Safety Appliances Co.) a measured volume of dirty air is passed through a cylindrical glass collecting tube fitted with a central wire electrode, maintained at 15,000V with respect to a gauze electrode wrapped round the glass tube. The dust particles are precipitated on the inside of the tube, whence they are washed down for evaluation by sedimentation.

The tendency now is to substitute microprojection of dust samples for direct counting of particles under the microscope, though the electron-microscope is likely to be more capable than the optical variety. Precipitated samples are heated before microscopic resolution for removing atmospheric pollution particles from the mineral dust it is desired to evaluate, since their size ranges overlap ; such incineration is worthy of further research.

Filtering methods are employed for estimating mass of dust per unit volume in air-borne clouds, though the Tyndallometer measures the intensity of light scattered by the dust in a known volume of air. For determining the mineralogical nature of air-borne particles of the smallest sizes recourse must be had to X-ray and electron-diffraction methods.

Of the various ways of protecting workers against industrial dusts the author devotes most space to mechanical ventilation and localised exhaust, mentioning as a good example of the latter the conveyor assembly of lead accumulator plates in the works of the Chloride Electrical Storage Co., Ltd. The fog sucked away through ducting is deposited in settling chambers of various kinds, in which respect electrostatic precipitation will filter out dust and fumes of the very finest sizes with high efficiency. A useful bibliography of references to this subject is included.

Back-Pressure Plant

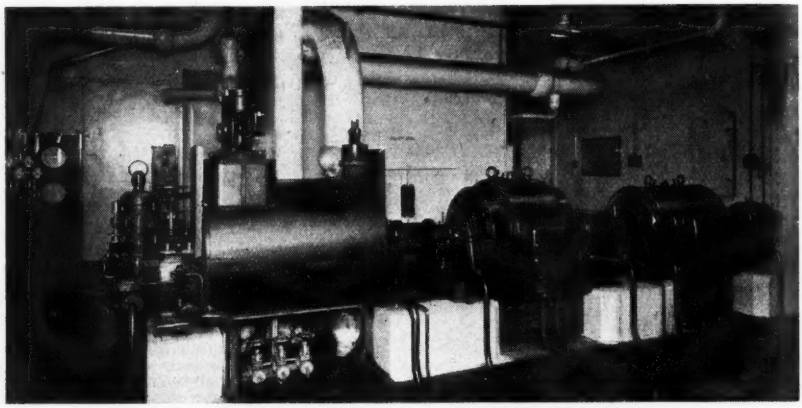
Novel Method of Linking up with Supply System

AS a stand-by and supplementary source of energy, Whitbread & Co., Ltd., have recently installed at their brewery a back-pressure set which incorporates some unusual features. Operation in parallel with the supply system not being permitted by the undertaking, a 400-V squirrel-cage inductor was installed for normal running and a synchronous alternator connected to independent busbars as stand-by to the external supply. Each component (turbine, inductor and alternator) is rated at 350 kW at 3,000 RPM.

Steam from the boilers at 175 lb. per sq. in. and 475 deg. F. passes through a regulating valve to the turbine, provided the quantity is sufficient to cover the needs of the brewery.

In practice the inductor is loaded almost to capacity in order to minimise the motor-generator losses which would at times occur with a more equal division of load between the two machines. With the inductor out of circuit, the quantity of steam passing through the turbine is varied by the governor in accordance with the electrical load, but as soon as the set is connected to the external supply system through the inductor the speed is governed by the supply frequency and automatic back-pressure control operates so as to maintain a constant pressure at the turbine-outlet flange.

As export of energy to the supply system is not desired, in the event of the output of the inductor being greater than that required by the brewery an " anti-export device " reduces the output of the turbine. This device consists of a Nalder-Sayer power-control relay arranged between the external system and the brewery busbars and acting on the turbine governor through a small electric motor.



The turbine-alternator-inductor plant at Whitbread's brewery

When more is required, it goes through a reducing valve to supply the brewery at 50 lb. per sq. in. A steam accumulator may be installed later to equalise the output of the boilers with the fluctuating steam demands.

If the load on the alternator increases beyond the mechanical power available at the turbine coupling the speed of the set drops slightly below that corresponding to the supply frequency and the inductor, acting as a motor, assists the turbine to drive the alternator. Should the turbine output be larger than is required for driving the alternator, the speed rises above the synchronous and the inductor generates energy, the power taken from the external system being reduced accordingly. The inductor has a slip of only 1 per cent. at full load either way so that the alternator frequency variation does not exceed 2 per cent.

When the quantity of steam required by the brewery is greater than that allowed to pass by the anti-export or the inlet-pressure controls (which are both arranged to overside the back-pressure control), the reducing valve supplies the balance. The effect is that if the turbine tends to pass steam at a greater rate than that corresponding to the set boiler firing rate, its load is reduced and the exhaust pressure tends to fall, so that the peak process-steam demand would be thrown on the accumulator.

The electrical relay incorporated in the

anti-export control is bi-directional in action so that after the control has operated import of energy is resumed and the turbine load is automatically increased to the maximum permitted by the speed, back-pressure and live-steam-pressure controls. All four controls can be operated in conjunction with one another.

Should the inductor lose its load when the turbine is under back-pressure governing, the rise of speed will be checked at a maximum of 5 per cent. above normal, thus avoiding operation of the emergency governor which is set for 12 per cent. over-speed. A contact, actuated by the spindle of the main steam valve, is arranged in the trip-coil circuit of the circuit-breaker so as to cut out the inductor as soon as the valve closes.

The turbo-generator set was supplied by Oerlikon, Ltd., and the scheme was prepared by McLellan and Partners, the consulting engineers, in collaboration with Mr. E. G. Morris, the chief engineer of Whitbread & Co., Ltd.

INSTITUTION PROCEEDINGS

South African Views. Cartridge Fuses

Statistical Control of Quality

HOW statistical control might be exercised over the quality of materials utilised as well as the products manufactured, to improve immediately the output of all forms of munitions of war, was discussed at a special joint meeting of the INSTITUTIONS OF CIVIL, MECHANICAL AND ELECTRICAL ENGINEERS in London on April 15th.

The subject has been developed simultaneously and independently in Britain and the United States to a degree that has made the methods immediately available in such a simple form as will avoid any diminution of output during their initiation. That increased quantities of accepted products will result within remarkably short periods of the introduction of these methods is said to have been borne out in factories in which statistical control has been applied during the past few years. The underlying theory was described in B.S. 600 (1935), while its practical application was concisely dealt with in an interim revision of that specification and also in B.S. 1008 (1942), which was an authorised reprint of an emergency defence document of the American Standards Association.*

Choice of Tolerances

Dr. C. G. Darwin introduced the subject by considering the tolerances which were assigned in engineering design. How they were chosen was not often clear; the inclination to keep them close always conflicted with the endeavour to make them easy so as to help the manufacturer. One of the great merits of the statistical method was that it provided reasoned instead of guessed values.

For example, a manufacturer might easily make shells to explode within one-fifth second of the time set by the fuse, so that half of them might be expected to burst within the stipulated lethal region; whereas to make more shells effective would necessitate a setting of one-tenth second, which would reduce the manufacturer's output to one quarter. If the gunner, by accepting the larger tolerance, secured four times as many shells (of which half were effective) he would in fact double his rate of killing. That over-simplified example illustrated how both user and maker, before fixing the tolerances they were respectively willing to admit, could benefit from guidance afforded by direct knowledge of each other's limitations.

The right answers to such questions as that one were provided by the statistical method, which had several virtues, many aspects and was applicable in different ways and to a variety of quantities. When statistical control had been introduced it could afterwards be maintained much less intensively by batch sampling at intervals to reveal when something was commencing to go wrong often long before direct visible signs appeared and sometimes showing that the tolerances achieved were a good deal finer than they needed to be. Statistical theory also provided a simple answer to the question of what fraction of the whole need be tested, which was important when samples were destroyed in testing.

Popular Exposition

Sir Frank Gill endeavoured to explain the statistical foundations of quality control in a simple way. If some quality (a dimension) of a number of similar articles were measured individually, the frequency distribution of the majority would cluster round about an average, which could be converted by the probability theory into the value appropriately derivable from a very large number of measurements instead of relatively few. Data so obtained was graphically employed to construct a chart on which frequent measurements, for example, of the product

* Obtainable from the British Standards Association 28, Victoria Street, London, S.W.1 (5s. for the specification and 3s. 6d. each for the revision and reprint).

of a machine-tool could be plotted to show the nominal dimension required, plus and minus tolerance limits, average dimension actually produced and two statistical control limits, rather finer than the tolerance limits, and set quite easily by the simple application of multipliers (based on probabilities) to the figures obtained from measurements.

The chart furnished "news" not "history," current information about the degree to which the desired qualities were being embodied in the product, the extent of variation to be expected (inevitable and so harmless), cases in which samples exhibited tendencies that were harmful, or actual "action points," so affording warning for instant action before the tolerance limits were reached. The main object was to so improve the uniformity of the product as to confine substantially all the plotted points within two statistical limits. When such a "state of control" existed a train of benefits accrued.

Anyone who studied the fundamentals would become more expert for so doing, but the properties of the charts were so well known that it would be quite wrong to imagine that they could not be applied without the assistance of statistical experts who also had factory experience. Care was needed to prevent an impractical mind from disturbing production, but many factory engineers were quite competent to take simple directions and observe the rules. A sort of primer illustrating the first steps to be taken when starting to control quality in this manner would shortly become available to those intending to proceed with the practical study of the method.

South African I.E.E.

THE presidential address of Mr. J. S. Trelease (Victoria Falls and Transvaal Power Co., Ltd.) to the SOUTH AFRICAN INSTITUTE OF ELECTRICAL ENGINEERS in Johannesburg on February 26th was largely concerned with the benefits to be derived from co-operation. He instanced the electric power industry as an outstanding example of what could be done in this way. Referring to the groups concerned with power supply on the Witwatersrand, he said that close working agreements between the mining groups and the Victoria Falls Co. had been maintained for some 30 years, and since 1925 they had had the collaboration of the Electricity Supply Commission, resulting in arrangements for the construction and operation of the Witbank and Klip power stations. Linked with the operations of these bodies they had the assistance and support of local manufacturers as well as that of representatives of overseas manufacturers.

Two aspects of co-operative association in power supply work which were assuming greater importance than ever were load factor and interconnection. In regard to the former he intimated that it would be necessary to look to the mining groups to see whether they could, by rearranging their loadings, accomplish a temporary but substantial increase in load factor—he wondered whether it was in the bounds of possibility to go to, say, 81 or 82 per cent. The need arose from the serious delay in the installation of new generating plant due to war conditions. Equipment for the new station on the Vaal River had been on order for nearly three years, he said, but it was impossible to give even a reasonable estimate of the date when the sets would be supplying power. If new demands were to be met improvement of load factor was an obvious line of approach. In the past 15 years the load factor of the V.F. Co.'s system, expressed monthly, had varied from about 69 per cent. to 78 per cent. That variation might not seem large, but approximately 87 per cent. of the power generated was absorbed by the mining industry in which shift working and daily processes were of a routine nature.

Apprentices and Improvers

The retiring president, Mr. C. A. Marshall, in addressing the annual meeting of the Institute, spoke on the subject of training in the electrical engineering industry. He favoured the system of employing youths who had completed their apprenticeships as improvers for not more than twelve months so that the responsibility of becoming fully qualified tradesmen should not be thrust suddenly upon them. He realised that trade unions objected to the employment of improvers on the grounds that some employers might abuse the system, but he thought this difficulty could be overcome. Many apprentices were keen and these should have their wages raised before their twelve months' service as improvers was finished.

In large organisations it was an advantage to transfer apprentices from one type of work to another. In the engineering department with which he was associated apprentices were transferred every three months, after an initial period of eighteen months to two years in the workshop itself. At the end of each period apprentices were questioned and their progress was recorded. He had noticed that apprentices were reluctant to remain in the workshops for long on what was termed "armature winding," preferring to be employed on outside jobs. He understood their point of view and agreed that apprentices from the larger municipalities, power companies, railways and mines who had all-round training in central station practice and experience in distribution, etc., had the advantage over those who only had training in shop practice.

An increasingly large number of apprentices were being engaged in consequence of the

Order of the Controller of Industrial Man Power requiring that an extra apprentice should be employed for every apprentice who had completed not less than three years of his course. He hoped that in this respect the young men who had been on war service and had returned disabled would not be forgotten.

The foregoing abstracts are taken from reports of the two addresses published in the *South African Mining and Engineering Journal*. The full addresses are given in the *Transactions* of the South African I.E.E.

Cartridge Fuses

HOW circuit protection technique has been affected by the development of high-rupturing-capacity fuses for use at high voltages is discussed in a paper by Mr. K. Dannenberg (Electric Transmission, Ltd.) and Professor W. J. John (Queen Mary College, University of London) submitted to the Transmission Section of the INSTITUTION OF ELECTRICAL ENGINEERS in London on April 15th.

The construction of the two-element type, which is powder-filled, is outlined and two recently introduced special features are described in detail. First, adaptation for oil immersion has necessitated the substitution of a tube made of fabric material for the ceramic holder in order to withstand the mechanical stresses. Oil-tightness is secured by so electro-depositing metal as to form a sealing cap at each end of the fuse in intimate contact with the fabric material forming the outer container. A washer of special composition under considerable compression is incorporated as a final barrier.

Ensuring Three-phase Operation

Secondly, to ensure all three phases tripping in the event of only one fuse being "blown," striker-pin mechanism is embodied in connection with a piston within a chamber containing gunpowder, or other explosive agent. Part of the high resistance interrupting wire of the fuse passes through the chamber so that when it "blows" the powder explodes and drives the piston forward, causing the striker-pin to pierce the end seal of the cartridge. This movement is utilised to trip a relay, thereby closing an auxiliary circuit that ensures three-phase operation. The type having the striker-pin outside the cartridge lends itself more readily to the operation of switch tripping gear.

After brief reference to discriminative operation between fuses and other protective gear, experiments are described to indicate the ability of the filling powder to prevent corona formation on the fusible conductor. An explanation is included of the way in which the magnitude of transient voltages produced when a fuse functions can be reduced by changing the section of the fusible element in one or more places.

Oscillogram records show how unsatisfactory performance due to the production of transients of a high order can be caused by too fine grain size of the filling powder. Immediately the size is enlarged from 0·005 to 0·008 or 0·01 mm. diameter a considerable reduction of the larger transient voltage follows. These results support the theory that an arc drawn in very small holes produces a high arc voltage that increases with reduction of size of hole, which is equivalent to decrease of the available space between powder grains when the latter are made smaller. Oscillograms (ordinary and cathode-ray) illustrate the behaviour of high-voltage fuses rated at from 3 to 200 A on short-circuit in an ordinary 50-cycle system and also when subjected to a test specially devised to reproduce the conditions obtaining when a mercury-vapour rectifier backfires.

High-voltage fuses designed on the principles discussed in this paper are now commercially available for three-phase circuits in rupturing capacities up to 1,000 MVA at 66 KV, 500 MVA at 33 KV, or 400 MVA at 11 KV.

Additional Protection

The latter section of the paper suggests how fuses of this kind may be employed to improve fuse-switches, or as a back-up to safeguard old circuit-breakers in cases in which the short-circuit burden has been increased, or in combination with a very simple load-breaking switch of the air blast type, which deals with small overloads only, leaving greater overloads and all short-circuits to be taken care of by the fuse. The respective ranges of load and rupturing capacity of these several combinations are illustrated diagrammatically by the authors, as are also their relative costs. The degree of certainty with which fuse action will follow short-circuits only (not be caused by overloads) depends upon the time/current characteristics of the switch and fuse portions respectively, the correct control of which renders such a combination practicable.

Fluorescent Lighting

MR. J. N. Aldington, B.Sc., read a paper on "Fluorescent Light Sources and their Application," at a meeting of the ILLUMINATING ENGINEERING SOCIETY in London, on April 14th.

Referring to the two distinct types of fluorescent lamp, both employing the mercury vapour discharge as the source of primary radiation, Mr. Aldington said that in the first type envisaged as long ago as 1900 by P. Cooper Hewitt, a high pressure mercury arc operated with a high luminous efficiency and fluorescent coatings on the outer bulb containing the arc tube were employed to

produce colour modulation of the emitted light. Ultra-violet and violet radiation of a wave-length above about 3,000 Å, was absorbed by suitable inorganic sulphides and was re-emitted in the visible region to supplement the dominant mercury light.

The change in overall efficiency brought about by this energy transformation was negligible but the effect on the colour rendering properties of the emitted light was appreciable and useful. The red content of the light from the fluorescent high-pressure mercury lamp could be increased from three to five times by the use of suitable phosphors. The fluorescent powder employed required to be operated at as low a temperature as possible in order to obtain the maximum effect.

The second type of light source was exemplified in the 80-W. MCF/U lamp which was being used extensively for industrial lighting. Its development in the form of a mains voltage lamp followed earlier work on high-voltage tubing and was consequent on the introduction of the hot cathode of low work function. A fluorescent powder layer coated on the inside surface of the tube containing the low-pressure mercury discharge was so vigorously excited by the resonance radiation from mercury that it produced about ten times the light given by an uncoated tube of similar size. The light was white and had colour rendering properties sufficiently close to those of daylight for most industrial applications. The fluorescent layer was not a single substance but was produced by a mixture of inorganic powders developed to be most efficiently activated by mercury radiation of wave-length 2537 Å. The various powders used separately would give blue, yellow and red light and a whole range of other hues could be produced by the use of suitable phosphors.

Effect of Ambient Temperature

Unlike that of the tungsten filament lamp the light output of the low-pressure fluorescent lamp was somewhat dependent on ambient temperature. The maximum light output was developed over the temperature range met with under normal conditions of use corresponding with a tube temperature of approximately 45 deg. C. Account must be taken of this characteristic in the design of fluorescent lamp fittings, particularly fittings of the enclosed type or in cases where more than one tube was to be operated in a single fitting.

The 80-W lamp was designed primarily for wartime industrial lighting. Much experience had, however, been gained in America where in the last three years fluorescent lamps had been introduced into practically every lighting field—in the home, in hotels, and restaurants, in theatres, in schools and in most branches of industry and for many special purposes.

The low-surface brightness of approximately 0.5 candle per sq. cm. in the case of the 80-W lamp and the large size of the source rendered it of great value for producing illumination conditions which could be made to approach daylight interior lighting. Shadows were softened and in a well-designed installation the illumination of vertical planes could be made effectively. On a three-phase supply special wiring arrangements could be used to completely remove the possibility of stroboscopic effects.

In all probability a return to normal conditions must be awaited before it would be possible to introduce fluorescent lamps in a range of sizes and colours. The progress which had been made marked the beginning of a new era in the development and utilisation of light sources probably as important as that which followed the advent of the gas-filled tungsten filament lamp.

Scottish Centre

THE forty-second annual report of the Scottish Centre of the INSTITUTION OF ELECTRICAL ENGINEERS records an increase in membership from 933 to 986. At the meetings so far held there has been an average attendance of 58 compared with 56 last session. Mr. W. Sutcliffe has been elected chairman for 1942–43.

The report of the Dundee Sub-Centre shows that there was an average attendance of 32 at the first three meetings. Mr. R. B. Anderson has been elected chairman for 1942–43.

The Scottish Students' Section also records a further steady increase in membership, from 250 to 280. All the Centre meetings were held jointly with the Students' Section, in addition to which the Section held four independent meetings up to the end of February at which there was a satisfactory attendance.

A paper on "The Failure of the Technician in his Role as a Citizen" (ELEC. REV., December 12th, 1941) was presented by Dr. Anderson to meetings of the Students' Section at Edinburgh and Glasgow on April 8th and 9th, respectively.

Informal Luncheon

THE Meter and Instrument Section of the Institution of Electrical Engineers is holding an informal luncheon on Friday, May 8th, at the Holborn Restaurant, London, W.C.1. Tickets (7s. 6d. each, exclusive of wines) can be obtained from the Secretary of the Institution, Savoy Place, London, W.C.2.

To give members from the provinces coming to the luncheon an opportunity of attending a Section meeting, the May meeting will be held on the same day at 6 p.m. when Mr. G. W. Bowdler will read a paper on "Measurement on Impulse Voltages with a Ballistic Galvanometer."

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

Fuel Economy

THE electricity supply for a large hospital in Essex is taken from a power company which agreed to the installation of a 250-kVA back-pressure steam generating set solely for standby and emergency purposes. The steam set is designed to work on normal boiler pressure and exhaust into the calorifiers of the heating system. During winter months the heating steam requirements are sufficient for the generation of the whole of the electricity requirements of the hospital under present wartime conditions.

The power company readily agreed to the suggestion that on the grounds of fuel economy the generating set should be run in substitution for the public supply between 7 a.m. and 7 p.m. on each winter day and at such other times as this might be economical. For every 50,000 kWh so generated the overall saving of fuel will be approximately 35 tons.

The power Company offered a rebate to the consumers in respect of the economies they would make due to running of the set during their peak hours and the saving of fuel.

The hospital is a new one and the standby plant was installed to utilise heating steam and while the conditions may be exceptionally favourable to such an arrangement, nevertheless there may be other cases where a similar economy could be made as a contribution to the national effort.

*London, W.C.*1. E. W. DOREY.

Supplies of Rubber

ARISING from the restricted supply of raw rubber, it can confidently be expected that it will not be long before the rubber manufacturing industry is officially listed for concentration.

It will not be a subject with which it will be easy to deal, having regard to the variety of goods which are made under each roof. It will, however, be obvious to everyone that apart from the need for concentration in the national interest, there is also the need of the individual manufacturer who finds that he is left with a number of departments which cannot be run efficiently on the volume of rubber licensed for the purposes involved.

There is not much doubt that voluntary arrangements to bring about concentration would result in quicker and better results than if an official scheme had to be worked out and applied. Manufacturers are advised, therefore, to consider what departments in their factories are not likely to bring them efficient results having regard to the reduced volume of production, and to approach other manufacturers who will be in similar circumstances, with a view to making some individual bargains which, if the Board of Trade approves, could be adopted without delay. The India Rubber Manufacturers' Association is prepared to keep a register of those manufacturers desiring to be placed in touch with others in connection with this subject, and to do what it can to make any necessary introduction. The address of the I.R.M.A. is: The Royal Exchange (Rooms 236 and 237), Cross Street, Manchester, 2.

Manchester. L. V. KENWARD,
Chairman,
India Rubber Manufacturers' Association.

Incendiary Bomb Detection

THE article in your issue of April 3rd bearing the above title should have been headed "An Impact Detector." The fire blitz on various cities in this country has shown that buildings are subject to the impact of very many things besides incendiary bombs. One building I have seen has eighteen penetrations, seventeen of which were by concrete and one by a shell nose-cap, the impact of all of which would have been detected by the so-called incendiary bomb detector and would have resulted in the unnecessary calling out of the Fire Service.

Incendiary bombs can be satisfactorily detected only from the light initially emitted by the thermite or other igniting content. That has already been recognised by the Government and BS/ARP/60 describes in detail how these light detectors should be made. Thousands of them have already been used and the B.S.I. has collected information and opinions from users showing that they regard these bomb detectors as worth a 50 per cent. increase in their fire-watching personnel.

J. MORTIMER HAWKINS.

*London, E.C.*4.

Institute of Industrial Administration

THE Institute of Industrial Administration (London Branch) has arranged five lectures by Mr. L. Urwick on "The Elements of Administration": (1) Forecasting and Planning, (2) Organising, (3) Commanding, (4) Co-ordinating, (5) Controlling. The lectures will be given on Thursdays, May 14th to June 11th, from 6.30 to 8.0 p.m. in the Portland Hall, Polytechnic Extension Building, Little Titchfield Street. Tickets for the course are 10s. 6d., and application should be made to the Institute Offices, Artillery House, Artillery Row, London, S.W.1.

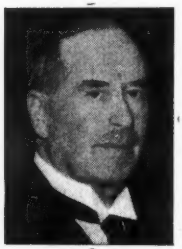
PERSONAL and SOCIAL

News of Men and Women of the Industry

AS a result of the entrance scholarship examinations held at Faraday House Electrical Engineering College on March 24th, 25th and 26th, the following awards have been made :—**Mr. J. Cripps** (Cheltenham Grammar School) : " Faraday " scholarship of 80 guineas a year tenable for two years in College and one year in one of the works affiliated with the College. **Mr. G. A. W. Tuffs** (Plaistow Municipal Secondary School) : " Maxwell " scholarship of 60 guineas a year tenable for two years in College and one year in works. **Mr. D. S. Scruby** (Whitgift Grammar School) : an exhibition of 60 guineas a year tenable for one year in College and one year in works.

Mr. A. M. Baer has resigned his seat on the board of Henry Gardner & Co. on his appointment as Joint Controller of Non-Ferrous Metals.

Mr. E. Gimingham has resigned from the board of the Edison Swan Electric Co., Ltd., after practically fifty-seven years' service with the company. When Sir Joseph Swan built his first important lamp factory at Newcastle he invited the late Mr. Charles Gimingham to join him. Mr. C. Gimingham was at that time working for Sir William Crookes but accepted the appointment and sent for his younger brother Edward. Mr. E. Gimingham made the first vacuum flasks for Sir James Dewar and the first oscillator valves for Sir Ambrose Fleming, for whom he also conducted the experiments leading up to the production of the first practical radio valve. The most important of Mr. Gimingham's own inventions for the lamp industry was the " Point-o-lite " lamp for microscopic, oscillographic, photographic and optical illumination. The modern version of this lamp, still bearing the name Mr. Gimingham gave it, is very little altered in design. Another interesting example of his work was the old Ediswan " Bi-life " which incorporated a reserve filament for emergency use, the second filament being brought into use by the removal of a mica separator from one of the contacts in the cap. His work on the Fleming-Gimingham voltmeter was instrumental in bringing into use one of the first practical voltmeters for general use.



Mr. E. Gimingham

For years after the introduction of the incandescent lamp commercially the Edison & Swan United Electric Light Co. held the monopoly in lamp-making, and each would-be inventor of a new lamp came to grief on the rocks of the combined patents taken out by Edison & Swan on experimental lamps. There came a time, however, when a judge ruled that the company must prove its ability to make these lamps practically, and the whole Court personnel moved to a factory at Ponders End where Mr. Gimingham himself made the lamps, one by one, and put them on circuit. The factory still stands and the lamps, with their High Court labels still attached, are in the Ediswan collection of historic lamps.

Sgt.-Pilot R. A. Eshelby, R.A.F., V.R., formerly technical assistant in the " Philora " Department of Philips Lamps, Ltd., was second pilot of a Wellington bomber engaged in the Scharnhorst-Gneisenau Channel action, after which he was reported missing. We are glad to hear that he is a prisoner of war and uninjured.

The marriage took place in London last week of **Lt.-Col. W. A. Vignoles,** D.S.O. (a director of Evershed & Vignoles, Ltd., and a former director of the British Electrical Development Association) and Miss E. M. Stapley.

Mr. J. S. Trelease, B.Sc.Tech., M.I.E.E., who has been elected president of the South African Institute of Electrical Engineers for the current year in succession to Mr. C. A. Marshall, is electrical engineer to the Victoria Falls and Transvaal Power Co., Ltd. He was born at Liskeard, Cornwall, in 1894, and received his technical education and training at the College of Technology, Manchester, and with British Westinghouse and Metropolitan-Vickers. From 1921 to 1926 he was assistant technical engineer to Salford Corporation, and from then until 1929 he carried out the duties as electrical clerk of works at Barking power station. For the next seven years, before going to South Africa, he served with Messrs. Merz & McLellan on the construction, commissioning, etc., of the grid scheme in South-east England.

Mr. C. Collins has been appointed a director of Scophony, Ltd., in place of the late Mr. O. Deutsch.

Mr. H. B. T. Wilde, F.C.A., has joined the board of Veritys, Ltd.

Mr. J. Innes, Director of Telecommunications, General Post Office, has been appointed Deputy Controller-General of the Mines Department.

Mr. W. D. Lovell, special technical assistant with the Bradford electricity undertaking has been appointed deputy borough electrical engineer at Sunderland at a salary of £853 per annum. Mr. Lovell was with the Cleveland & South Durham Electric Power Co., Ltd., from 1913 to 1923, and from 1923 to 1928 he was substation superintendent in Bradford Electricity Department. During the next ten years he was deputy, and later chief, engineer to the Perak River Hydro-Electric Power Co., in Malaya, afterwards returning to Bradford.

Mr. H. F. Broadway, chief clerk to the Hammersmith Electricity Department, retired on April 5th at the age of 64 years after 41 year's service. The occasion was marked by gifts of a tobacco pipe and a cheque for the purchase of a

greenhouse. The presentation was made by Mr. J. R. Jones, borough electrical engineer.

Owing to shortage of staff Steatite & Porcelain Products, Ltd., have withdrawn **Mr. A. J. Evans** from the London area to take up a temporary position at the works. Their London technical representative, **Mr. R. Bolsover,** Bendhill Cottage, Blacksmith's Hill, Sanderstead, Surrey, will remain available to deal with technical matters in the London area.

Obituary

Mr. P. Kelly.—We regret to record the death, on April 5th, of Mr. Patrick Kelly, managing director of the Edison Swan Electric Co., Ltd., chairman of the Cable Manufacturers' Association and member of the Council of E.L.M.A. Mr. Kelly entered the electrical industry twenty-eight years ago, joining the General Electric Co., New York, where he was engaged on construction work. With the entry of the United States into the Great War he joined the U.S. Army, served in France and was granted a commission there in 1918. He returned to America and on demobilisation went to the International General Electric Company at Schenectady.

In 1920 Mr. Kelly was engaged by the British Thomson-Houston Co. and went to India as manager of the Bombay office. On completion of three years' service he was re-engaged by the I.G.E. and returned to the Schenectady office. In 1924 he was attached first to the London office and later to the Paris office of the I.G.E. Four years later he returned to London to take charge of the merchandising sales of the B.T.H. Co. Mr. Kelly was only forty when he was appointed managing director of the Edison Swan Co. He would have celebrated his fifty-fourth birthday in June.

Mr. M. W. Woods.—The death occurred on April 9th at Exmouth, at the age of seventy-six, of Mr. Maurice Walter Woods, founder of M. W. Woods, Ltd., electrical and ventilating engineers, of Colchester.

Mr. Samuel Barbour Wilson, whose death has occurred at Kilmarnock at the age of sixty-six, was a director and the secretary of Glenfield & Kennedy, Ltd.

Forthcoming Events

Institution of Electrical Engineers.—Monday, April 20th, 6 p.m. Informal discussion on "The Applications of Electricity in Hospitals," to be opened by Mr. C. Morgan Davies.—Thursday, April 23rd, 6 p.m. Kelvin Lecture: "The Future of Transoceanic Telephony," by Dr. O. E. Buckley.

Installations Section.—Thursday, April 30th, 6 p.m. Informal discussion on "Electrical Installation Problems in War Factories," to be opened by Mr. W. R. Watson.

London Students' Section.—Wednesday, April 22nd, 7 p.m. Annual meeting.

North-Western Centre.—Saturday, April 18th, 2.30 p.m. Engineers' Club, Albert Square, Manchester. Annual meeting and paper on "The Management of Protective Gear on Power Supply Systems," by Messrs. W. Casson and F. H. Birch, B.Sc.

South Midland Centre.—Monday, April 20th, 6 p.m. James Watt Memorial Institute, Birmingham. "A Critical Review of Education and Training for Engineers," presented by Dr. A. P. M. Fleming, C.B.E., M.Sc. for the Education, Training and Personnel Sub-Committee of the Post-War Planning Committee.—*Students' Section.*—Wednesday, April 22nd. Address by the Centre chairman, Mr. R. H. Rawll.

Mersey and North Wales (Liverpool) Centre.—Monday, April 20th, 6 p.m. Liverpool Royal Institution, Colquitt Street. Annual meeting and short papers.

Devon and Cornwall Sub-Centre.—Thursday, April 23rd, 5.30 p.m. (tea 5 p.m.). Continental Hotel, Millbay Road, Plymouth. "Public Address Systems," by Mr. S. Hill.

Western Centre.—Thursday, April 23rd, 6 p.m. South Wales Institute of Engineers, Park Place, Cardiff. Joint meeting with Institution of Mechanical Engineers to hear lecture by Mr. H. C. Weston on "Industrial Health Research and the War Effort."

Scottish Centre.—Tuesday, April 28th, 6.15 p.m. Royal Technical College, George Street, Glasgow, C.1. Annual meeting followed by Dr. A. P. M. Fleming's: "A Critical Review of Education and Training for Engineers," to be read by Mr. S. E. Goodall.

North Midland Students' Section.—Saturday, April 25th, 2.30 p.m. Hotel Metropole, King Street, Leeds. Paper on "Switchgear," by Mr. A. R. Rumfitt.

Royal Society of Arts.—Mondays, April 20th, 27th and May 4th, 1.45 p.m. John Adam Street, Adelphi, W.C.2. Cantor Lectures: "The Distribution of Electricity," by Mr. E. Ambrose, M.I.E.E.—Wednesday, April 29th, 1.45 p.m. "The Post-War Home—Lighting, Heating and Ventilation," by Mr. R. Fitzmaurice, B.Sc., A.M.Inst.C.E., Mr. J. S. Highfield, M.Inst.C.E., M.I.E.E. presiding.

Association of Supervising Electrical Engineers.—Tuesday, April 21st, 6.15 p.m. Lighting Service Bureau, W.C.2. "Earthing as applied to Factory Installations," by Mr. F. E. Butcher.

Institution of Mechanical Engineers.—Friday, April 24th, 5.30 p.m. "Review of Recent Progress in Heat Transfer," by Professor C. H. Lander, C.B.E., D.Sc.

Junior Institution of Engineers.—Saturday, April 25th, 1 p.m. for 1.30 Holborn Restaurant, W.C.1. Annual luncheon.

Midland Section.—Saturday, April 18th, 2.30 p.m. James Watt Memorial Institute, Birmingham. Demonstration and talk: "Synchrophone as an Aid to Wartime Training," by Mr. N. Sandor, M.I.Mech.E.

Sheffield Section.—Tuesday, April 28th, 6.30 p.m. Central Library, Surrey Street, Sheffield. Same as for Midland Section.

British Institution of Radio Engineers.—Saturday, April 18th, 3 p.m. 21, Tothill Street, S.W.1. "Future Developments in Communication Technique," by Mr. P. P. Eckersley, M.I.E.E.

Association of Mining Electrical and Mechanical Engineers.—Saturday, April 18th, 6 p.m. South Wales Institute of Engineers, Cardiff. "The Performance Characteristics of Fans," by Mr. A. L. Davies.

Guidance for Contractors

Some Recent E.C.A. Memoranda

MEMBERS of the Electrical Contractors' Association continue to receive much helpful advice from the Director (Mr. L. C. Penwill) and the latest series of memoranda sent to them deals with a number of important matters.

First it is announced that the existing rates of pay, including the weekly war addition of 18s. 9d. are to remain in force until the first pay-day in July.

Electricians in the Forces

In our issue of April 3rd we reported a widening of the scope of the inquiries by the Beveridge Committee on Skilled Men in the Services. The Director of the E.C.A. asks members who have knowledge of skilled electricians in the Forces whose abilities are not being properly utilised to send him particulars. In each case there should be given the man's service number, rank, full name, Service and unit or corps, his normal civilian occupation and the service trade in which he is mustered, if this is known.

Distribution of Appliances

Reference is made to the recent statement regarding the unfair methods of certain concerns in connection with the production and distribution of electrical appliances made by the Electrical Fair Trading Council (see ELECTRICAL REVIEW, March 20th, p. 375). The Director appeals to members to co-operate in the endeavour to secure that established retailers shall not be unfairly treated. Any member who has information concerning the availability of electrical apparatus from premises which have been established as electrical retailers since the beginning of the war is asked to supply full information regarding the make and type of the apparatus in question and if possible the source of supply.

Mr. Penwill says that he has recently received information concerning certain "black market" activities in the electrical industry. Personal calls have been made upon members who have been offered electrical goods at unjustifiable prices. The retailer is tempted to buy such goods as are in great demand but short supply and as he is quite content with his normal profit he does not himself gain an undue reward.

Members are reminded of their obligations under the Price Controlled Goods (Invoices) Order. They must see that invoices contain the correct name of the seller and address of his principal place of business; the correct name of the buyer and the address to which the goods are being sent; a sufficient description of the goods and their number or quantity; the prices paid or charged or agreed to be paid or charged for each item; and the date of the sale or contract of sale of each item.

A retailer who does not receive an invoice in accordance with these requirements within fourteen days of receiving the goods is required by the Order to ask the supplier for a proper invoice and at the same time to report the matter to the Local Price Regulation Committee. Cases are mentioned of irregularities brought to the attention of the Central Price Regulation Committee and it is stated that experience has shown how dangerous it is to buy from strangers.

Compulsory Service

In circulating for members' guidance copies of the Ministry of Labour leaflet on deferment from military service, Mr. Penwill says that at present the position of electrical contracting operatives is that those employed in protected establishments who were 28 years of age at the date of registration became de-reserved on April 1st; those in non-protected establishments who were 38 at the date of registration were de-reserved on the same date. Attention is drawn to the procedure to be adopted where men over 35 employed in protected establishments have received de-reservation notices.

As regards women employees, members are reminded that those between the ages of 20 and 31 are liable to be called upon, but members can take advantage of the deferment procedure previously notified to them.

Mention is also made of the removal of the restriction upon the engagement of women between the ages of 20 and 31 by electrical contractors otherwise than through an Employment Exchange.

Another memorandum deals with compulsory enrolment in the Home Guard and states that it is intended that there should be adequate consultation with employers before directions are issued to their employees.

It is not the intention of the Ministry of Labour and National Service to require men to join the Home Guard if they will not be available for immediate mustering in case of invasion, such as key workers in vital war industries and services, or men who are essential for Civil Defence duties, including fire prevention duties at business premises.

Use paper carefully; save all waste

COMMERCE and INDUSTRY

Allocation of Man Power. Production Planning

The Budget

ON Tuesday last, Sir Kingsley Wood, Chancellor of the Exchequer, opened the fifth war Budget, which, he claimed, would contribute to the country's financial stability. In announcing his proposals for the ensuing year he said there would be no increase in income tax and a number of reliefs would be conceded to wage earners — including an increase of £35 in the personal allowance for married women war workers. All workers would be granted a £10 travelling allowance and certificates of post-war credits would be issued.

Increased duties would be imposed upon tobacco, beer, wines and whisky and the purchase tax upon a number of luxury articles would be doubled. These articles included electric razors and musical instruments (not including radio sets).

The Chancellor said that the National Defence Contribution would be continued from year to year, but he announced no alteration in the Excess Profits Tax arrangements which had been the subject of considerable discussion in advance of the Budget.

The Supply of Labour

The seventh report of the session from the Select Committee on National Expenditure (Stationery Office, 6d.) deals at length with the problems connected with the supply of labour for industry. It covers such matters as the distribution of man power between industry and the fighting forces; the recruitment of labour into the munitions industry, with particular reference to the employment of women; training schemes; and the nature and operation of the departmental organisation for dealing with labour.

No fewer than forty-one recommendations are made by the Committee. The first is that a permanent committee, independent of Departments and reporting direct to the War Cabinet, should be set up to estimate the best allocation of man-power between industry and the fighting services and to examine the allocation of man-power between the broad categories of industries. It is considered that employers should make greater efforts to employ women, and compulsion should be resorted to where women are available and employers cannot be induced to engage them.

The Committee recommends that greater care should be exercised in the selection of candidates for training schemes so that only those possessing the mental ability and manipulative aptitude should be accepted. It is thought that greater powers of supervision should be given to the Regional Boards to ensure the efficient utilisation of labour within their areas.

Organisation of Production

In its eighth report (Stationery Office, 3d.) the Select Committee on National Expenditure presents the results of investigations made in factories and works and among employers, workers, Ministry of Labour officers and other Government representatives. The aim was to make proposals for the more efficient planning and execution of production programmes.

Among the recommendations made by the Committee is that the Minister of Production should give unified direction to the national plan and see that it is made sufficiently far ahead. The plan should be so devised as to produce the minimum domestic needs and the maximum fighting efficiency from the available resources. There should be decentralisation by the Supply Departments for arranging and supervising the details of production, *i.e.*, more power should be given to the regional representatives and manufacturers should be grouped, if possible, to give industry a greater responsibility in the work of settling how to deliver the goods required by the Supply Departments.

More active steps should be taken to ensure that good methods developed in one factory are made known to others and that the most efficient works are brought up the fullest employment in priority to the less efficient. Among other matters touched upon is income-tax. It is considered that certificates for post-war credits should be issued. All possible steps should be taken to enable workers in factories to gain a true understanding of the war position and of the conditions affecting the work in which they are engaged.

Companies in Enemy-Occupied Territory

An Order made by the Board of Trade provides that British companies registered in Hong Kong, Shanghai and Singapore may be registered in the United Kingdom and may deal with their assets outside the territories which have been occupied by Japan. This removes a number of disabilities which would otherwise arise, for ordinarily these companies would be treated on the same basis as enemy concerns.

Poplar's New Demonstration Theatre

Probably no London borough has suffered more severely from enemy bombing than Poplar, and with large areas in the borough made uninhabitable, the electricity undertaking has had many difficulties with which to contend. Under the able direction of Mr. R. Illingworth, the borough electrical engineer and general manager, these difficulties have been surmounted and the undertaking continues to meet the demands made upon it by consumers.

At the outbreak of war new offices and showrooms were in course of construction in East India Dock Road, but in common with many similar schemes through the country, work had to be suspended. Approval, however, was eventually given to the completion of the offices and the demonstration theatre. The former have been in use by the staff of the undertaking for some considerable time, and the demonstration theatre was opened for the first time on Thursday of last week. The theatre is constructed on modern lines, with the seating arranged in tiers for about 100 people. The stage is of liberal dimensions, divided by folding

doors, so that the back part can be screened off when not required. Talkie apparatus has been installed for film displays. Under existing conditions the theatre cannot, of course, be used for the purposes for which it was designed; nevertheless, a weekly programme of wartime cooking demonstrations has been arranged which will prove of value to housewives not only in making the most of their rationed and unrationed foods, but also in showing them how they can obtain the best results with the minimum consumption of electricity.

Last Thursday's opening of the theatre was quite informal. It included musical interludes, three films and a demonstration of wartime cookery by Mrs. L. E. Leach, the Electricity Department's chief demonstrator. An interesting point of the demonstration was that the cooking was done with a cooker which had been repaired by women.

Power Station Engineers' Holidays

The Industrial Court recently issued an award (see ELECTRICAL REVIEW, April 3rd, p. 440) reducing the holidays of power station staffs with six months' service (under Clause 10 of the Schedule) from fourteen to seven days during 1942. At the same time it was stated that the holidays of engineers with longer service (Clauses 11 and 12) were unaltered except that they need not be consecutive. Now the Court states that a slip occurred; the alteration in Clause 10 requires a consequential alteration in Clauses 11 and 12. The effect is that employees with one year's service are entitled to seven days' holiday (instead of fourteen) with an additional day for each additional year of service up to a maximum of fourteen days (instead of twenty-one).

The Electrical Power Engineers' Association, in referring to the "very drastic amendments", says that pending consideration by the staff side of the National Joint Board Negotiating Committee further comment is withheld.

Dismissed Employee's Superannuation

Weymouth Corporation has decided to return superannuation fund contributions with interest to an employee in the Electricity Department whom they dismissed last year, Mr. C. W. J. Condon, a charge engineer. As we reported at the time, Mr. Condon's services were terminated on the ground that he had taken extended leave without permission. The solicitors to Mr. Condon's association (the E.P.E.A.) demanded his reinstatement and intimated that they had been instructed to issue a writ against the Corporation for wrongful dismissal. Before commencing action they suggested an interview for the purpose of discussing the possibility of arriving at a settlement.

The Town Clerk had two interviews with the solicitors. He told them that the Council was not prepared to reinstate Condon, but if they decided not to proceed with litigation he would suggest to the authority that it should repay the money which Mr. Condon had contributed to the superannuation fund, with interest. If the case were proceeded with, however, this offer would be withdrawn.

The Electricity Committee reported at the last meeting of the Council that the offer had been accepted. Replying to one of the councillors, who doubted whether the money could be withheld, the Town Clerk said, "The Act of Parliament governing this matter lays down that in the case of dismissal for misconduct the local authority has the discretion of either paying back contributions with interest or of not paying them back at all."

Distribution of Catalogues

Since the publication in our March 27th issue (p. 410) of the note under this heading dealing with the effects of the Control of Paper (No. 36) Order, readers have raised a number of questions. These have been submitted to the Controller of Paper who has kindly expressed the following opinions regarding the interpretation of the Order. At the same time he points out that such interpretation is not his duty; only a Court of law is competent to settle such matters.

The Controller considers that sub-paragraphs (1) (a) and (1) (b) of Article 6 of the Order should be read in conjunction and it would appear that the gratuitous distribution of advertising circulars printed on or after November 12th, 1941, are prohibited by sub-paragraph (1) (a) except in so far as they relate to the sale or loan of books. Where such circulars were printed prior to November 12th, 1941, their gratuitous distribution is permissible to the extent provided for in sub-paragraph (1) (b) (*i.e.*, in any three months after March 31st, 1941, three-twentieths, by weight, of the amount distributed in the corresponding quarter of the year ended August 31st, 1939). The word "gratuitously" is capable of two interpretations; the meaning employed in the Order is "free of charge."

It would appear that any general distribution of advertising catalogues to firms engaged on Government contracts or to Government Departments would be subject to the restrictions imposed by the Order except in so far as the distribution of such catalogues is necessary for the fulfilment of any contracts made with the Crown.

Advertising calendars, it would seem, are "advertising circulars" within the meaning of the Order and their distribution is subject to the restrictions imposed. The Controller says, however, that the general question of such calendars is now under consideration by the Ministry of Supply and that an announcement may be expected in the near future.

Inquest on Colliery Victims

During the continuation of the inquest on the victims of the Barnsley Main Colliery explosion Mr. J. A. Hall, president of the Barnsley Mineworkers' Association, remarked, "Sooner or later we are going to force the withdrawal of electricity from mines. We are not going to tolerate this constant loss of life." Mr. A. Benford, manager of the colliery, said that the flash from the cable connected to the electric coal cutter had not caused him to alter his views regarding the use of electricity in coal mines. The one lesson to be learned was, in his opinion, that the construction of trailing cables needed altering. There could be danger from coal-cutting machines worked by compressed air.

On the concluding day of the inquiry Prof. I. C. S. Statham, professor of mining at Sheffield University, said he had come to the conclusion that there was a "short" between the phases in the electric cable which gave rise to the flash

which ignited the gas. He thought that the most likely cause of the " short " was a breakage of some of the wires of the core, that the broken ends had penetrated between the cores, and that this had happened after the cable had left the surface.

The deputy coroner, in reviewing the evidence, said the flash from a trailing electric cable had started a fire, and, in his opinion, the cable was not sufficiently examined before the current was switched on. The regulations provided that electric cables should be examined once every shift, but he suggested that the regulations should be amended to provide for examination at the commencement of each shift. The workmen's representatives had asked him to recommend the exclusion of electricity from mines, but that was a highly technical matter which he proposed to leave in the hands of the Commissioner. The verdict in each case was " Death by misadventure."

Hammersmith Warship Week

Hammersmith's contribution to London's Warship Week was an inspiring effort. The campaign had been planned well ahead of inauguration date and received the co-operation of manufacturers and commercial houses in the district. The week was launched by a procession through the main thoroughfares which included attractively decorated wagons " manned " by women war workers. Throughout the week large crowds attended the Town Hall to see the " Exhibition of the Allies ". Local contributions to this exhibition included a display sponsored by the Osram Lamp and Valve Works which showed by large photographs and by practical demonstrations how Hammersmith's womenfolk are " going to it " to speed equipment for the Navy. Band concerts and other forms of entertainment were also provided at the exhibition which proved an effective inducement to join the ranks of women war-workers.

Inquiry into Production

The Advertising Service Guild (a group of eight independent advertising agencies) has a wider conception of these agencies' functions than is usually held. From the members' peacetime experience of industry and commerce sprang a desire to aid in wartime production and one means adopted is the promotion of surveys into fundamental problems of war activity and organisation. The results of these are published in the Guild's bulletin *Change*. The third issue of this contains the first part (entitled " People in Production ") of an inquiry into war production; it is being published to-day (Friday) by the Guild, whose address is 10, Hertford Street, London, W.1 (price 10s.) It is proposed to publish the second part, " Economic Strategy," in about a fortnight's time at 5s.

The survey was carried out for the Guild by Mass Observation, an independent, scientific, fact-finding body, and it studies the human element in industry very thoroughly. In the introductory section the methods adopted are outlined and then the report proper gives representative examples of opinions on the subject of production from many people. Next comes a chapter on the available personnel and its make-up, including a great deal on women workers to whom the third part (covering such matters as part-time work, day nurseries, and shopping hours, as well as hours of work, rates of pay and absenteeism) is of considerable interest. Physical and mental questions are dealt with in the fourth part and the fifth covers the relationships of workers and employers.

This bulky publication is full of interest and useful information for all in industry and for the Government Departments concerned.

Indian Electrical Contractors

Reviewing the activities of the Electrical Contractors' Association of Bengal at its annual meeting the president (Mr. F. T. Griffin-Chave) spoke of the increased difficulties experienced owing to restrictions on goods imported from England. He announced the decision of the Minister-in-Charge of the Commerce Department to take steps to ensure the enforcement of one of the Indian Electricity Rules (No. 48) to which attention had been drawn and tendered thanks to Mr. Redclift, Electrical Adviser and Chief Electrical Inspector, for his assistance in this and other matters, and also to the Calcutta Electric Supply Corporation, Ltd., for its co-operation. The *Indian and Eastern Engineer*, reporting the meeting, states that the following officers were elected for 1942:—President, Mr. F. T. Griffin-Chave (F. & C. Osler Ltd.); vice-president, Mr. P. Bose (Satal Engineering Works); Council members, British Insulated Cables, Ltd., English Electric Co., Ltd., Phillips & Roy, P. P. De & Co., Russa Garage & Electrical Works, Ltd., General Electric Co. (India), Ltd., Balmer Lawrie & Co., Ltd., Precision Electrical Equipment Co., Premier Engineering Co., B. C. Gooptu & Co., and Mr. S. S. Bagchi.

Economy in Cables

Having regard to recent events in the Pacific, the Electricity Commissioners have drawn the attention of electricity supply authorities to the need for the utmost economy in the use of copper, lead and other materials. They ask undertakings to take full advantage of the carrying capacity of existing wires and cables and to employ overhead rather than underground construction wherever possible.

The Materials Committee of the Ministry of Production has called for certain particulars including past consumption and present stocks of cables.

Pulley Calculator

A new pulley calculator available from Newman Motors Ltd., Yate, Bristol (price 2s. 6d.) should prove of great practical utility to all draughtsmen and engineers who have pulley problems to solve. Though representing the end of an electric motor, it is n effect a circular slide rule specially designed to simplify the calculation of pulley sizes.

Trade Announcement

Thorn Electrical Industries, Ltd., announce that their Service Department at the Ferguson Radio Factory, Enfield, will be closed until further notice. In the meantime all inquiries relating to the servicing of Ferguson receivers and to " Mary Ann " domestic appliances should be sent to T.E.I. Service Department, 64, Jersey Street, Ancoats, Manchester, 4.

ELECTRICITY SUPPLY

Restrictions at Bury. Re-employment of Superannuated Men.

Blackpool.—LOANS.—Application is being made by the Electricity Committee for sanction to borrow for mains and plant.

Bury.—BAN ON NEW CONSUMERS.—The Electricity Committee has had under consideration the difficulty of obtaining materials required to connect up new consumers. It has been decided that applications already in hand shall be dealt with, except where extensions to mains are required, after which no new consumers will be connected while the present restrictions are in operation, unless such connections are for essential or emergency purposes.

Cheltenham.—SUBSTATION PLANT.—The Electricity Committee is to increase the transformer capacity of substations at a cost of £4,721.

Eccles.—CHANGE-OVER.—We regret that in our last issue it was erroneously reported that the Electricity Committee was to change over the supply in Eldon Place, Arthur Street and Tetlow Grove from DC to AC. Actually the change is from single-phase, 200V, to three-phase, 400/230V.

Glasgow.—HANDLAMPS FOR GAS DEPARTMENT.—The Corporation Gas Committee has arranged for the Electricity Department to install lighting points and plug points for handlamps with explosion-proof fittings at a cost of £120.

MAINS EXTENSIONS.—The Corporation Electricity Committee is to extend mains at a cost of £10,954.

FUEL SUPPLIES.—The Corporation has formed a new committee to investigate the whole position of fuel supplies to the municipal undertakings. It has been increasingly evident that the fuel received was not adequate to the maintenance of all the requirements of the city utilities, of which the most important is the electricity undertaking. Although fair supplies have been coming from collieries depletion of stocks has continued.

Stalybridge.—RE-EMPLOYMENT OF PENSIONED STAFF.—The Stalybridge, Hyde, Mossley and Dukinfield Joint Transport and Electricity Board has approved the principle of re-employment, during the war, of persons in receipt of superannuation allowance from the Board, provided they are fit and willing; the period of re-employment does not exceed twelve months unless otherwise agreed; and the superannuation allowance during re-employment does not include any additional allowance granted by the Board by virtue of the Superannuation Act.

Overseas

Eire.—HARNESSING THE ERNE.—Speaking in the Dail recently on the difficulty of procuring machinery and power for Gaeltacht (Irish speaking region) industries in Donegal, Mr. P. O'Grady, Parliamentary Secretary to the Minister of Lands, said that they could not hope to solve the problem completely till they had harnessed the Erne, and he hoped that this would become possible in the near future.

Canada.—ONTARIO CONVENTION.—A resolution passed at the recent annual convention of the Ontario Municipal Electrical Association approved the appointment of a committee to co-operate with the Hydro-electric Power Commission in planning the conservation of power. At the same time the opinion was expressed, in another resolution, that the Power Controller should be urged to allow farmers to use more power. It was decided not to hold a summer convention this year. Mr. K. A. Christie, K.C. (Toronto) was elected president in succession to Dr. W. J. Chapman (St. Catharines).

ELECTRICAL EXPANSION.—The output last year established a new record at 33,445.3 million kWh, an increase of 3,365.1 million kWh (11 per cent.) over the 1940 total of 30,080.2 million kWh; in 1939 the output was 28,351.5 million kWh and in 1938 it was 26,012.8 million kWh. By the withdrawal of secondary power sold for steam purposes, notably to the pulp and paper industry, there was actually an increase of 5,215.4 million kWh in Canada's production of firm central electric station power, of which Quebec accounted for about two-thirds or 3,483.1 million kWh, followed by Ontario with an increase of 1,163.5 million kWh.

TRANSPORT

Newcastle-on-Tyne.—PURCHASE OF TROLLEY-BUSES.—The Transport and Electricity Committee has received consent from the Ministry of War Transport to acquire seven double-decker trolley-buses. The chassis will be supplied by Karrier Motors, Ltd., at a cost of £1,842 (plus war risk insurance) each.

Sweden.—COMPLETION OF ELECTRIC LINE.—The Swedish International Press Bureau reports that electrification of the northern main line of the Swedish State Railways has now been completed, the last section to be finished being between Langsele and Boden. Thus, electric traction now operates from Trelleborg in the extreme south of the country to Riksgransen in the north of Lapland, a distance of 1,260 miles. This is believed to be the longest continuously electrically operated railway in the world. About 41 per cent. of the 10,470 miles of the State Railways has now been electrified and 85 per cent. of the traffic is electrically hauled.

INFORMATION DEPARTMENT

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by our Information Department through the post. Inquirers should send a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the following:—

VOGUE washing machine.

Chimney sweeping equipment.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

A. Reyrolle & Co., Ltd., report a net profit for 1941 of £160,340, as compared with £169,471 for the preceding year. The figures are struck after providing for taxation and depreciation. Reserve receives £50,000, and it is proposed to pay a final dividend on the ordinary stock of 7½ per cent., again making 12½ per cent. for the year, less tax. The balance carried forward is £145,421 (against £146,845 brought in).

The Telegraph Construction & Maintenance Co., Ltd., in its accounts for 1941 shows a trading profit of £148,066, an increase of £44,282 as compared with 1940. Investments and other income amounts to £12,883 (against £15,170). The net profit for the year was £50,825 (against £47,569). Directors' fees absorb £5,897, auditors' fees £315 and pensions £10,614. The dividend for the year is maintained at 10 per cent., and £40,572 is carried forward, an increase of £5,383.

Pinchin, Johnson & Co., Ltd., in a preliminary statement, report a profit of £310,859 for 1941, a decrease of £19,488 as compared with the previous year, but the 1941 figure is struck after writing off £19,471, representing value of stocks in enemy hands which have been omitted in inventories at December 31st. The final ordinary dividend is 6 per cent., maintaining the distribution for the year at 8½ per cent., less tax, and the balance carried forward is raised by £789 to £151,772.

The Electric Supply Corporation, Ltd., reports a profit for 1941 of £59,492, as compared with £58,118 for 1940. The fina ordinary dividend is 6½ per cent., making 10 per cent. less tax for the year (same) and £37,453 is carried forward (against £36,087 brought in).

Igranic Electric Co., Ltd.—It is announced by Metal Industries, Ltd. that it has acquired over 90 per cent. of the ordinary shares of the Igranic Co. and the whole of the issued preference shares.

The Ever-Ready Trust Co., Ltd., is paying a final dividend on the ordinary stock and deferred shares of 6 per cent., making 9 per cent. for the year (unchanged).

Worthington-Simpson, Ltd.—Trading profit for 1941 amounted to £90,203 (against £82,118) and after meeting debenture interest and taxation (£55,237 against £42,460) there was a net profit of £17,065 (against £20,279). The ordinary dividend is maintained at 7 per cent.

Telephone & General Trust, Ltd.—In a statement issued in advance of the annual meeting on April 20th Sir Alexander Roger (chairman) states that in spite of war difficulties the business of the Anglo-Portuguese Telephone Co. is being well maintained. The Nacional Company in Venezuela, in which they are interested through Telephone Properties, Ltd., also continue to do well as do the companies in Jamaica, Trinidad and Barbados. Sir Alexander refers to the effects of E.P.T. upon the ordinary dividends of Telephone Properties, Ltd. (vide last week's issue, p. 482).

Dealing with the investment trust movement, Sir Alexander says that its successes have far outstripped its losses and it has contributed in great measure to the expansion of British trade. He considers that when the war ends there will still be pioneer work for the trusts which will find employment for people in this country and benefit the countries concerned.

The accounts show a net profit of £97,962 (against £102,287). The final dividend on the ordinary stock is 5 per cent., again making 8 per cent. for the year and the dividend on the "A" ordinary shares is also maintained at 8 per cent. The investments stand at £2,527,326 and a valuation at the end of 1941 showed a depreciation of 2.9 per cent. during the year.

The Rawlplug Co., Ltd., announces a final dividend of 30 per cent., making 40 per cent. for the year (same).

New Companies

Buck & Bromley, Ltd.—Private company. Registered March 27th. Capital, £1,000 in 1,000 shares of £1 each. Objects: To carry on the business of manufacturers of, and dealers in, insulators, condenser packings, dynamos, motors, armatures, magnetos, transformers, electrical plant, tramcars, motor buses, cars, cycles and accessories, etc. The directors are: W. E. Buck, 22, Woodhurst Road, W.3, and H. G. Bromley, 424, Greenford Avenue, W.7. Registered office: 10, Wendell Road, W.12.

Hygrade Products, Ltd.—Private company. Registered March 31st. Capital, £1,000. Objects: To carry on the business of electrical radiological, acoustic, hydraulic, mechanical, marine, heating, sanitary and general engineers, manufacturers of and dealers in tools, wireless and television parts and equipment and engineering requisites, etc. Directors: M. J. Carr, 6, Little Plucketts Way, Buckhurst Hill, Essex, and C. M. Wood, 85, Princes Road, Buckhurst Hill, Essex. Registered office: 81, Lancaster Avenue, Hadley Wood, Herts.

J. & J. Couch, Ltd.—Private company. Registered April 2nd. Capital, £1,000. Objects: To acquire the business of wireless and electrical engineers carried on as Couch Bros. at Gabriel Street, The Stennack and Chapel Street, St. Ives. Directors: James Couch, and James Couch, jnr., both of 2, Gabriel Street, St. Ives, Cornwall, and J. Couch, 3, Atlantic Terrace, St. Ives. Registered office: 6, Gabriel Street, St. Ives.

Companies' Returns

Statements of Capital

Perak River Hydro-Electric Power Co., Ltd.—Capital, £3,500,000 in 1,250,000 5 per cent. cumulative preference, 1,750,000 ordinary and 500,000 "A" shares of £1. Return dated December 23rd. All preference and ordinary shares taken up. £808,041 paid on 400,000

preference and 408,041 ordinary shares. £2,191,959 considered as paid on 850,000 preference and 1,341,959 ordinary shares. Mortgages and charges: £752,900.

Keighley Electrical Engineering Co., Ltd.—Capital, £10,000 in 7,000 ordinary and 3,000 preference shares of £1 each. Return dated November 14th (filed December 22nd). 4,256 ordinary and 2,300 preference shares taken up. £4,544 paid. £2,012 considered as paid. Mortgages and charges: £7,500.

Willet & Robinson, Ltd.—Capital, £7,000 in £1 shares (3,000 "A" cumulative preference, 1,000 "B" cumulative preference and 3,000 ordinary). Return dated December 23rd. 3,000 cumulative preference and 3,000 ordinary shares taken up. £6,000 paid. Mortgages and charges: £8,390.

Sloan Electrical Co., Ltd.—Capital, £60,000 in £1 shares (10,000 preference and 50,000 ordinary). Return dated December 24th. 8,000 preference and 40,000 ordinary shares taken up. £41,500 paid. £6,500 considered as paid. Mortgages and charges: £60,500.

British Brown-Boveri, Ltd.—Capital, £50,000 in £5 shares. Return dated December 26th. All shares taken up. £21,250 (£2 10s. per share) paid on 8,500 shares. £7,500 (£5 per share) considered as paid on 1,500 shares. Mortgages and charges: Nil.

Langleys (Kensal Rise), Ltd.—Capital, £2,500 in 2,500 shares of £1 each. Return dated December 29th. 2,054 shares taken up. £416 10s. paid (being 5s. per share on 1,650 and £1 per share on 4). £100 considered as paid on 400 shares (5s. per share). Mortgages and charges: Nil.

Brown & Co. (Electrical Engineers), Ltd.—Capital, £5,000 in £1 shares. Return dated December 12th. 4,529 shares taken up. £12 paid. £4,517 considered as paid. Mortgages and charges: Nil.

Bolton Electrical Traders, Ltd.—Capital, £1,500 in 1,500 shares of £1 each. Return dated November 6th (filed December 22nd). 1,000 shares taken up. £1,000 paid. Mortgages and charges: Nil.

John Dugdill & Co., Ltd.—Capital, £10,000 in 10,000 shares of £1 each. Return dated November 4th. All shares taken up. £3 paid. £9,997 considered as paid. Mortgages and charges: Nil.

Simplex Electric Co., Ltd.—Capital, £500 in £1 shares. Return dated December 29th. All shares taken up. £500 paid. Mortgages and charges: Nil.

Mosbrough Electric Supply Co., Ltd.—Capital, £5,000 in £1 shares. Return dated December 29th. 3,275 shares taken up. £3,275 paid. Mortgages and charges: Nil.

B. French, Ltd.—Capital, £5,000 in 5,000 shares of £1 each. Return dated December 30th. 4,755 shares taken up. £4,755 paid. Mortgages and charges: Nil.

Tubes, Ltd.—Capital, £215,000 in 215,000 ordinary shares of £1 each. Return dated December 24th. All shares taken up. £107,584 paid, being £1 per share on 82,859 and 10s. per share on 49,450. £107,416 considered as paid (£1 per share on 92,691 shares and 10s. per share on 49,450 shares). Mortgages and charges: Nil.

Simplex Conduits, Ltd.—Capital, £100,000 in 100,000 ordinary shares of £1 each. Return dated November 3rd. 90,000 shares taken up. £50,000 paid. £40,000 considered as paid. Mortgages and charges: Nil.

Credenda Conduits Co., Ltd.—Capital, £50,500 in 50,500 ordinary shares of £1 each. Return dated November 3rd. All shares taken up. £30,500 paid. £20,000 considered as paid. Mortgages and charges: Nil.

Walsall Electrical Co., Ltd.—Capital, £7 500 in £1 shares (5,000 ordinary and 2,500 preference). Return dated November 8th. 4,400 ordinary and 1,725 preference shares taken up. £6,125 paid. Mortgages and charges: Nil.

Corwen Electric Light Co., Ltd.—Capital, £2,000 in £1 shares. Return dated November 19th. 1,610 shares taken up. £1,610 paid. Mortgages and charges: Nil.

Increase of Capital

London Electrical Co. (Blackfriars), Ltd.—The nominal capital has been increased by the addition of £4,000, in £1 ordinary shares, beyond the registered capital of £16,000.

Mortgages and Charges

Electrical Finance & Securities Co., Ltd.—Satisfaction to the extent of £6,641 on November 1st, 1941, of trust deeds dated July 29th, 1927, July 6th, 1928, April 24th, 1930, and January 29th, 1932, and registered July 29th, 1927, July 10th, 1928, April 29th, 1930, and February 1st, 1932, respectively. (Notice filed April 1st, 1942.)

Kelvin-Norton Electric Co., Ltd.—Equitable charge on moneys due under an order, dated March 26th, 1942, to secure all moneys due or to become due from the company to the Midland Bank, Ltd.

Underwood (Electric), Ltd.—Assignment of contract moneys dated March 19th, 1942, to secure all moneys due or to become due from the company to Martins Bank, Ltd., not exceeding £2,200.

A. E. Dees, Ltd.—Satisfaction to the extent of £250 on October 20th, 1941, of debenture registered June 30th, 1938. (Notice filed March 28th, 1942.)

Liquidations

Kent Dish Washing Machine Co., Ltd.—Meetings May 11th at 12, Lonsdale Gardens, Tunbridge Wells, to receive an account of the winding-up by the liquidator, Mr. E. Barwell.

Bankruptcies

F. E. Roberts, 272, Melfort Road, Thornton Heath, and **J. Savill**, 64, Woodville Road, South Woodford, E.18, electricians, lately carrying on business as Commercial Light, Heat & Power Co., 47, Poland Street, London, W.1, electrical engineers and contractors.—Last day for receiving proofs for dividends April 22nd. Trustee, Mr. L. A. West, Bankruptcy Buildings, Carey Street, London, W.C.2, Senior Official Receiver.

STOCKS AND SHARES

TUESDAY EVENING.

THIS being Budget week, Stock Exchange business should see a prospect of settling down shortly into normal conditions ; conditions, that is to say, that are not influenced by speculation as to what the Chancellor of the Exchequer may propose in the way of taxation. Broadly speaking, the outlook is for a continuance—possibly an emphasis—of the policy of cheap money. This was generally recognised in advance, with the result that prices remained firm in all the gilt-edged sections and in others which are governed by monetary considerations. Leading industrial companies are declaring, as a rule, dividends similar to those of a year ago.

Investment resolutely declines to pay heed to the Home Railway market, save in the case of the best prior-charge issues. It seems a little anomalous that the returns from Home Railway junior stocks should be, in some cases, twice, or more than twice as much, as those available from the purchase of industrial shares.

Taxation Effects

The Budget will probably be opened before these pages of the ELECTRICAL REVIEW are, and the advance speculation will then be resolved as to what the income tax is going to be, at all events for the time being. If the tax remains at 10s. in the £, this will mean such shares as those in the foregoing list affording a return at current quotations of £1 17s. 0d. per cent. net. Living costs are mounting; in spite of the restrictions upon supplies, the man and woman with fixed incomes find it increasingly difficult to make both ends meet. The Government policy of cheap money, advantageous as it is to the country in the financing of the war, has a harsh repercussion upon people dependent upon dividends for their incomes. When they wish to invest money nowadays, they find that the returns obtainable from good class stock are extremely modest. The somewhat ironical position has arisen of colossal sums being expended every day, while, concurrently, the prices of Stock Exchange securities advance in a manner which sensibly reduces the yield on stocks and shares.

High Prices

To give a convincing idea of the avidity with which investment is absorbing any good-class preference shares, it may be mentioned that the following shares all moved up 6d. or 1s. one day last week. In this list, the 6 per cent. preference shares in three cases stand at 32s. 6d., at which the return on the money is £3 13s. 10d. per cent. The two 4½ per cent. preferences of Bournemouth & Poole and London Associated return, at 22s. 6d., 4 per cent. on the money. Moreover, the following prices are middle quotations, which means that if a buyer wanted to get hold of the shares, he would probably have to pay more. On the other hand, these are days in which the seller of good-class stocks is assured of getting a high price for his investments.

Company	*Preference Dividend* %	*Price*
Bournemouth & Poole	4½	22/6
British Light & Power	6	31/6
County of London ..	6	32/6
Elec. Dis. of Yorks. ..	6	32/6
East African	7	28/9
London Associated ..	4½	22/6
Mersey Power ..	6	28/–
Mid. Counties ..	6	32/6

It may well be asked whether the high-priced preference shares are not standing at artificial values. The answer would be a decided affirmative were it not for the fact that if a holder of these shares sold them he would be in a quandary to know how to re-invest the money in shares giving equal security and a higher rate of income.

Electricity Supply

In the Electricity Supply market, the principal feature is the prevailing strength of ordinary and preference shares alike. Clyde Valley ordinary and Yorkshire Electric ordinary have advanced to the common level of 40s. Amongst the lower-priced shares, Isle of Thanet hardened to 11s. 3d. Electric Supply Corporation remain at 45s. The previous dividend of 10 per cent. is to be repeated in respect of the year recently ended. Indian electrical shares are dull, Calcuttas going back to their par value of 20s. Some of the Canadian utility issues are firmer, Shawinigan Power and Montreal Power both being better on the week.

North Metropolitan Power Station 3½ per cent. second " B " debenture stock is on offer as to £5,000 at 102½, ex the interest paid on the 1st of last month. Interest and sinking fund are provided by the Northmet Power Co. and the security, although the stock is termed a second debenture, is excellent. The company can redeem the issue at any time after September, 1951, at 100. In any case a cumulative sinking fund will operate to extinguish the stock at 100 by 1965. The flat rate of yield is £3 8s. 3d. per cent. Assuming redemption of the stock at 100 in 1951, the yield would be £3 3s. 6d. per cent.

Price Fluctuations

Reyrolle ordinary shares at 57s. 6d. are ex the dividend recently deducted and show no change. The net profit for 1941 is about £9,000 down as compared with the preceding year, for which extra taxation is the main

(*Concluded on page* 513)

ELECTRICAL INVESTMENTS

Prices, Dividends and Yields

Company	Dividend 1939–40	Dividend 1940–41	Middle Price Apl. 14	Rise or Fall	Yield £ s. d.
Home Electricity Companies					
Bournemouth and Poole	15	12½	55/–	..	4 11 0
British Power and Light	6	6	28/6	..	4 4 3
City of London	7	7	27/6	..	5 1 9
Clyde Valley	8	8	40/–	+6d.	4 0 0
County of London	8	8	37/6	..	4 5 6
Edmundson's:					
7% Pref.	7	7	35/–	+6d.	4 0 0
Ord.	6	6	28/6	..	4 4 3
Elec. Dis. Yorkshire	9	9	42/6	..	4 4 9
Elec. Fin. and Securities	12½	12½	46/3	..	5 8 2
Elec. Supply Corporation	10	10	45/–	..	4 9 0
Isle of Thanet	2	Nil	11/3	+1/16	—
Lancs. Light and Power	7½	7½	34/6	..	4 7 0
Llanelly Elec.	5½	5½	22/–	..	5 0 0
Lond. Assoc. Electric	4½	4	18/3	..	4 7 8
London Electric	6	6	25/–	..	4 16 0
London Power Red. Deb.	5	5	104½	..	4 15 7
Metropolitan E.S.	8	8	36/3	..	4 8 6
Midland Counties	8	8	38/9	..	4 2 0
Mid. Elec. Power	9	9	42/–xd	..	4 5 9
Newcastle Elec.	7	7	27/6	..	5 1 10
North Eastern Elec. Ordinary	7	7	31/3	+1/16	4 9 7
7% Pref.	7	7	34/6	+6d.	4 1 2
Northampton	10	10	46/3	..	4 6 7
Notting Hill 6% Pref. (£10)	6	6	8½	..	—
Northmet Power:					
Ordinary	7	7	35/9	..	3 18 4
6% Pref.	6	6	32/6	..	3 13 10
Richmond Elec.	6	6	25/–	..	4 16 0
Scottish Power	8	8	38/9	..	4 2 9
Southern Areas	5	5	21/3	..	4 14 1
South London	7	7	26/–	..	5 7 8
West Devon	5	5	21/3	..	4 14 1
West Glos.	4½	4½	22/6	..	4 0 0
Yorkshire Elec.	8	8	40/–	+6d.	4 0 0
Overseas Electricity Companies					
Atlas Elec.	Nil	Nil	4/–	..	—
Calcutta Elec.	8*	7*	20/–	–1/16	—
Cawnpore Elec.	10	10	25/–	..	8 0 0
East African Power	7	7	27/–	..	5 3 8
Jerusalem Elec.	7	5	18/9	..	5 6 8
Kalgoorlie (10/–)	7½	7½	9/6	..	7 12 10
Madras Elec.	6*	4*	15/–	..	5 6 8
Montreal Power	1½	1½	24	+½	6 5 0
Palestine Elec. "A"	Nil	Nil	18/9	..	—
Perak Hydro-elec.	6	7	5/–	..	—
Shawinigan Power	83cts.	90cts.	15½	+½	—
Tokyo Elec. 6%	6	6	12½	..	—
Victoria Falls Power	15	15	72/6	..	4 2 9
Whitehall Inv. Pref.	7½	5	15/9	..	6 7 0

Company	Dividend 1939–40	Dividend 1940–41	Middle Price Apl. 14	Rise or Fall	Yield £ s. d.
Public Boards					
Central Electricity:					
1950–70	5	5	110½	..	4 10 6
1955–75	5	5	114	..	4 7 9
1951–73	4½	4½	109	..	4 2 7
1963–93	3½	3½	104	..	3 7 4
1974–94	3½	3½	99	..	3 5 8
London Elec. Trans. Ltd.	2½	2½	94	..	2 13 2
London & Home Counties 1955–75	4½	4½	111	+1	4 1 1
Lond. Pass. Trans.:					
A	4½	4½	121½	..	3 14 1
B	5	5*	119½	..	4 3 8
C	3	2⅞	40½	+½	7 2 0
West Midlands J.E.A. 1948–68	5	5	110	..	4 11 0
Telegraph and Telephone					
Anglo.-Am. Tel.:					
Pref.	6	6	109½	..	5 9 8
Def.	1½	1½	25	..	6 0 0
Anglo-Portuguese	8	8	13/9	..	11 12 10
Cable & Wireless:					
5½ Pref.	5½	5½	94	..	5 7 0
Ord.	4	4	51½	..	7 15 2
Canadian Marconi $1	Nil	4cts.	5/6	..	3 0 0
Globe Tel. & Tel.:					
Ord.	8½*	8¼*	26/3xd	+2½d.	—
Pref.	6	6	26/3xd	+2½d.	4 11 5
Great Northern Tel.:					
(£10)	20	20	13	..	—
Inter. Tel. & Tel.	Nil	Nil	3	..	—
Marconi-Marine	7½	7½	28/9	..	5 4 4
Oriental Tel. Ord.	11½*	16	47/6	..	6 14 9
Telephone Props.	6	Nil	8/9	..	—
Tele. Rentals (5/–)	10	10	9/–	..	5 11 1
Traction and Transport					
Anglo. Arg. Trans.:					
First Pref. (£5)	Nil	Nil	5/–	..	—
4% Inc.	Nil	Nil	7½	..	—
Brit. Elec. Traction:					
Def. Ord.	45	45	915	..	4 18 3
Pref. Ord.	8	8	180	..	4 9 0
Bristol Trams	8	10	45/–	..	4 9 0
Brazil Traction	$1	50c.	12⅜	–⅜	—
Calcutta Trams	8	5½	12/6	..	8 16 0
Cape Elec. Trams.	5	5	19/–	..	5 5 3
Lancs Transport	10	10	45/–	..	4 9 0
Mexican Light:					
1st Bonds	5	5	77½	..	6 9 0
Rio 5% Bonds	5	5	96⅛	..	5 3 8
Southern Rly.:					
5% Prefd.	5	5	63½	..	7 17 6
5% Pref.	5	5	111½	..	4 9 6
T. Tilling	10	10	48/9	..	4 2 2
Tilling & B.A.	7*	6½*	55/–	..	2 7 3
West Riding	10	10	39/–	..	5 2 7

(*Continued on next page*)

* Dividends are paid free of Income Tax.

Company	Dividend 1939–40	Dividend 1940–41	Middle Price Apl. 14	Rise or Fall	Yield p.c. £ s. d.
Equipment and Manufacturing					
Aron Elec. Ord. ..	Nil	7½	24/–	..	6 5 0
Assoc. Elec.:					
Ord.	10	10	45/–	..	4 9 0
Pref.	8	8	38/9	..	4 2 4
Automatic Tel.& El.	12½	12½	47/6	..	5 5 3
Babcock & Wilcox	11	11	44/6	–6d.	4 18 9
British Aluminium	10	10	43/3	..	4 12 4
British Insul. Ord.	20	20	93/9	..	4 5 6
British Thermostat (5/–)	18½	18½	14/6	..	6 7 6
British Vac. Cleaner (5/–)	12½	10	10/–	..	5 0 0
Brush Ord. ..	Nil	Nil	4/6	..	—
Callender's ..	15	15	72/6	..	4 2 9
Chloride Elec.Storage	15	15	75/–	..	4 0 0
Cole, E. K. (5/–) ..	Nil	7	11/3	..	3 2 2
Consolidated Signal	17	17	75/–	–½	4 10 8
Crabtree (10/–) ..	17½	17½	29/6	..	5 18 8
Crompton Parkinson Ord. (5/–) ..	30	20	22/6	..	4 9 0
E.M.I. (10/–) ..	Nil	6	14/–	+3d.	4 5 9
Electric Construction	10	10	34/6	..	5 16 0
Enfield Cable Ord.	12½	12½	55/–xd	+1/32	4 11 0
Elecl. Switchgear (10/–)	16	10	20/–	..	5 0 0
English Electric ..	10	10	40/–	..	5 0 0
Ensign Lamps (5/–)	25	25	16/3	..	7 13 10
Ericsson Tel. (5/–)..	22½*	20*	41/3	..	2 8 6
Ever Ready (5/–) ..	40	40	31/–	..	6 9 0
Falk Stadelmann ..	7	7½	22/–	..	6 16 4
Ferranti Pref. ..	7	7	27/6	..	5 1 10
G.E.C.:					
Pref.	6½	6½	35/–	..	3 14 2
Ord.	20	17½	82/6	..	4 4 9
Greenwood & Batley	15	13	28/9	..	9 0 10
Hall Telephone(10/-)	15	10	16/3	..	6 3 1
Henley's (5/–) ..	20	20	22/6	..	4 9 1
4½% Pref. ..	4½	4½	22/6	..	4 0 0
Hopkinsons ..	15	15	46/3	..	6 9 10
India-Rubber Pref.	5½	5½	21/3	..	5 3 6
Intl. Combustion ..	32½	30	107/6	..	5 11 6
Johnson & Phillips	15	15	60/–	..	5 0 0
Lancashire Dynamo	20	20	65/–	..	6 3 1
Laurence,Scott (5/–)	15	15	11/–	..	6 16 4
London Elec. Wire	7½	7½	28/3	..	5 6 2
Lucas, J.	15	15	66/3	–9d.	4 10 9
Mather & Platt ..	10	10	38/9	..	5 3 3
Metropolitan Elec. Cable Pref. ..	5½	5½	21/3	..	5 3 6
Murex	20	20	92/6	+1/16	4 6 9
Pye Deferred (5/–)	25	25	15/–	..	8 6 8
Revo (10/–) ..	5	20	25/7½	..	7 16 0
Reyrolle	12½	12½	57/6xd	+9d.	4 7 0
Siemens Ord. ..	7½	7½	26/3	..	5 14 3
Smith, S. (1/–) ..	50	37½	7/–	..	5 7 2
Strand Elec. (5/–)..	2	4	3/3	..	6 3 1
Switchgear & Cowans (5/–).. ..	15	10	10/–xd	+3d.	5 0 0
T.C.C. (10/–) ..	Nil	5	11/3	..	4 9 0
T.C. & M.	10	10	40/–xd	+6d.	5 0 0
Telephone Mfg.(5/–)	9	9	9/–	..	5 0 0
Tube Investments	23½	20	82/–	..	4 17 7
Vactric (5/–) ..	4	Nil	5/6	+3d.	—
Vickers (10/–) ..	10	10	16/6	+3d.	6 1 3
Ward & Goldstone (5/–)	20	20	18/6	..	5 8 3
Westinghouse Brake	10	10	47/6	..	4 4 2
WalsallConduits(4/-)	55	55	33/9	..	6 10 4
West, Allen (5/–) ..	7½	7½	5/9	..	6 10 5

* Dividends are paid free of Income Tax.

Stocks & Shares (*Continued from page* 511)

reason. At the present price the shares give a return of £4 7s. 0d. per cent. on the money. Murex are a good spot at 92s. 6d., expectation looking for a final dividend to make 20 per cent. for the year, the same as before. The yield here is a modest £4 6s. 9d. but the company occupies a strong financial position and is well placed for business not only at present but after the war. Consolidated Signal shares at 3¾ show a fall of ⅛. Vickers strengthened to 16s. 6d. Babcocks at 44s. 6d. are 6d. lower. Vactrics again are harder at 5s. 6d.

Miscellaneous Matters

Ericsson Telephones are unchanged at 41s. 3d., the chairman explaining at the recent meeting that, although the gross profit for the past year was £3,800 up, the amount available for dividend payments was considerably reduced by taxation. London Passenger Transport C stock at 40½ is 10s. up, support being attracted by a reduction of rating assessments on the Board's properties. Cable and Wireless stocks held their previous prices, although a few sales took place upon last week's announcements of Japanese successes in the Pacific. Upon demand for Brazilian issues subsiding, Brazilian Tractions went back to 12¾.

Telegraph Construction

The Telegraph Construction and Maintenance Co., which manufactures telegraph, electric lighting and power cables and carries on cable repair business, shows a net profit for the year ended December 31st last of £50,825: an increase of £3,300. The trading profit is £44,000 up, equal to over 42 per cent. Taxation takes £39,700 additional. The company is again paying 10 per cent. for the year, the rate distributed since 1937 inclusive. In 1939 there was a capital bonus of 5 per cent. In the five years 1931/1935 inclusive, the company made three annual losses and paid no dividend during the period, but in 1936 the tide turned and, since then, profits and earnings have gone ahead. The price of the shares is 40s. middle. The lowest touched during the past decade was 14s. 6d. in 1933. Four years later the shares were up at one time to 53s.

Imports of Peru

Substantial Increase in 1940

PERU'S import trade in electrical goods in 1940 increased by over 20 per cent. in value compared with 1939, when there was a small setback in some items after a period of steady expansion for six years.

The accompanying statement, which has been extracted from the Peruvian foreign trade returns, shows the imports of the principal electrical lines in 1940, with the leading countries of origin, and a note of increases or decreases compared with the previous year. (£1 = 20 soles approx.). It will be seen that virtually all branches of the trade except telephone material participated in the increase.

The United States remained the leading supplier, with business valued at 8,667,000 soles out of an aggregate of 12,400,000 soles. The share of Germany, formerly second largest participant, dwindled to one-sixteenth of her 1939 total. Belgium ranked next, thanks mainly to large orders for telephone material. Canada's position was maintained. The United Kingdom improved her position but it was only a fraction of that of the United States.

Building construction has been fairly active in Peru and funds have been allotted for further work. Such enterprise entails the provision of electrical material of various descriptions. The amount of sterling exchange available has been increasing for many months. The Customs tariff has been revised and many rates have been raised 20 per cent.

	1940	Inc. or dec.
	Soles(000)	
Switches, circuit-breakers and similar accessories—		
Total	872	+ 309
From Germany	10	— 151
„ United States	745	+ 408
„ United Kingdom	11	—
„ Japan	32	+ 24
„ Canada	27	+ 13
Batteries, up to 30 kg. and parts—		
Total	688	+ 164
From Germany	7	— 31
„ United States	560	+ 138
„ United Kingdom	18	— 2
„ Japan	19	+ 6
Batteries, over 30 kg.—		
Total	31	— 29
From United States	28	— 18
Insulators—		
Total	190	+ 96
From United States	156	+ 123
„ United Kingdom	14	+ 1
Insulated covered wire and cable, up to 3 mm. diameter—		
Total	755	+ 337
From United States	519	+ 303
„ United Kingdom	11	— 1
„ Canada	70	+ 27
Wire and cable, up to 3 mm., lead-covered—		
Total	133	+ 34
From United States	19	+ 11
„ Italy	100	+ 94
Copper wire, over 3 mm. diameter, covered, etc.—		
Total	655	+ 271
From United States	501	+ 257
„ United Kingdom	5	— 7
„ Italy	142	+ 91
Copper wire, over 3mm. diam. lead-covered—		
Total	289	+ 194
From United Kingdom	8	+ 7
„ United States	155	+ 148
„ Italy	125	+ 76
Wire, insulated or uninsulated, lead-covered or armoured—		
Total	303	+ 123
From United States	98	— 5
„ Italy	204	+ 151
Flex, covered with fabric—		
Total	51	+ 1
From United States	38	+ 26
„ United Kingdom	1	—
„ Japan	8	—
Telephone cable, lead-covered—		
Total	206	— 70
From United Kingdom	163	+ 137
„ Canada	28	— 218

	1940	Inc. or dec.
	Soles(000)	
Telephone apparatus—		
Total	215	— 118
From Belgium	130	— 100
„ United States	42	+ 3
„ United Kingdom	7	— 24
Radio apparatus—		
Total	1,697	— 63
From Germany	39	— 221
„ United Kingdom	28	— 98
„ United States	1,316	+ 271
„ Holland	191	— 127
Radio valves—		
Total	215	+ 65
From United Kingdom	45	+ 11
„ Holland	17	+ 13
„ United States	137	+ 35
Household heating apparatus, not over 10 kg.—		
Total	84	— 6
From United States	70	+ 13
„ Japan	4	+ 2
Heating apparatus, heavier, including industrial—		
Total	841	+ 434
From Italy	261	+ 244
„ United States	454	+ 254
„ Switzerland	121	+ 121
Vacuum cleaners, etc.—		
Total	53	+ 19
From United States	52	+ 37
Unspecified electrical goods—		
Total	116	— 11
From United States	95	+ 11
Lamps up to 50 W—		
Total	565	+ 199
From Germany	1	— 68
„ United States	282	+ 147
„ Holland	37	+ 4
„ Japan	101	+ 47
Lamps over 50 and up to 200 W—		
Total	318	+ 60
From United States	198	+ 101
„ Holland	16	— 6
„ Sweden	46	— 30
Lamps, over 200 W—		
Total	71	+ 25
From United States	61	+ 36
House meters—		
Total	294	+ 94
From Switzerland	107	+ 47
„ Canada	140	+ 91
Electro-magnetic apparatus, medical—		
Total	969	+ 621
From United States	149	+ 25
„ Germany	537	+ 512
„ Italy	270	+ 245

(*Concluded on next page*)

Imports of Peru (*Concluded from previous page*)

Current transformers over 1 kW and rectifiers over 3 A—			
Total	872	+	237
From United Kingdom ..	8	—	5
,, United States	777	+	530
,, Switzerland	68	—	157
Insulating tubes—			
Total	89	—	53
From United States	81	—	36
Ammeters, galvanometers, etc.—			
Total	169	+	83
From United States	162	+	111
Fans—			
Total	100	+	71
From United States	99	+	75
Refrigerators—			
Total	563	—	23
From United States	561	—	17
Fractional HP motors—			
Total	117	+	30
From United States	109	+	32
Dynamos and spare parts—			
Total	169	+	35
From United Kingdom ..	21	+	19
,, United States	115	+	25
,, Switzerland	22	+	21
Switchboards—			
Total	669	—	18
From Germany	15	—	26
,, United States	277	+	194
,, United Kingdom ..	10	+	5
,, Belgium	353	—	197

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1*s. each*) *can be obtained from the Patent Office,* 25, *Southampton Buildings, London, W.C.*2.

1940

2320. "Lighting fixtures." Aktiebolaget Orrefors Glasbruk. March 14th, 1939. (543967.)

10829. "Television transmitting tubes." Marconi's Wireless Telegraph Co., Ltd. June 24th, 1939. (543890.)

12905. "Cathode-ray apparatus." G. H. Baillie (International Business Machines Corporation). August 12th, 1940. (543977.)

12953. "Electric couplings." J. W. Dalgleish and Pye, Ltd. August 13th, 1940. (543942.)

13698. "Frequency modulated radio altimeters." Marconi's Wireless Telegraph Co., Ltd. September 1st, 1939. (543943.)

14259. "Electric cable connections." J. Lucas, Ltd., and P. Griffiths. September 16th, 1940. (543900.)

14290. "Cooling towers." H. Ingerslev and Bierrum & Partners, Ltd. September 17th, 1940. (543866.)

14329. "Control of an internal-combustion engine or engines in a power plant." Sulzer Frères Soc. Anon. September 21st, 1939. (543916.)

14334. "Failure indicating systems for voltage conversion apparatus." Westinghouse Electric International Co. September 20th, 1939. (543983.)

14370. "Alternating-current generators." United States Instrument Corporation. August 8th, 1940. (543945.)

14383. "Rotors for turbines." Sulzer Frères Soc. Anon. September 25th, 1939. (543985.)

14395. "Steam generating and superheating installations." Superheater Co., Ltd. November 1st, 1939. (543987.)

15533. "Radio direction-finding means." Rediffusion, Ltd., and G. B. Ringham. October 21st, 1940. (543873.)

15849. "Means for securing glass or similar lights." Revo Electric Co., Ltd., and F. H. Reeves. October 30th, 1940. (543994.)

15941. "Cooling arrangements for dynamo electric machines." British Thomson-Houston Co., Ltd. October 31st, 1939. (543949.)

16222. "Rheostat devices." Sonotone Corporation. November 9th, 1939. (543919.)

16423. "Telephone systems." Automatic Telephone & Electric Co., Ltd., R. Taylor and G. T. Baker (A. C. Corner, in part). November 13th, 1940. (543876.)

17034. "Cathodes for cathode-ray tubes." British Thomson-Houston Co., Ltd., and L. Rushforth. November 29th, 1940. (543920.)

18042. "Methods of forming pellets on wires." Cinema-Television, Ltd., and G. A. R. Tomes. December 23rd, 1940. (543877.)

18139. "Fluid pressure and/or flow responsive electric switches." British Thomson-Houston Co., Ltd., B. G. Higgins and N. A. Tucker. December 26th, 1940. (543922.)

18229. "Washing machines." British Thomson-Houston Co., Ltd. December 29th, 1939. (543952.)

1941

75. "Modulation system for carrier-wave signalling." Standard Telephones & Cables, Ltd. January 9th, 1940. (543924.)

305. "Electric switches for selectively operating luminous signs." Neograph, Ltd., and F. Knepper. January 9th, 1941. (Addition to 523042.) (543997.)

4213. "Electric motor controllers." Igranic Electric Co., Ltd., and J. R. Taylor. March 28th, 1941. (543910.)

4772. "Machines for winding electric condensers." British Thomson-Houston Co., Ltd. April 10th, 1940. (543929.)

4899. "Prevention of condensation in water-heaters, boilers and like heat-exchangers." A. H. Greaves and R. V. Short. April 15th, 1941. (543930.)

7264. "Electric switches and relays." Electrical Research Products, Inc. June 15th, 1940. (543935.)

8649. "Electric time switches." C. W. Thorne and Horstmann Gear Co., Ltd. July 9th, 1941. (543960.)

Amended Specification

517649. "Electric condensers." British Insulated Cables, Ltd., and others.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Plymouth.—April 29th. Electricity Supply Department. Electrically operated overhead telpher plant and modification of part of existing telpher track and supporting structure. (See this issue.)

South Africa.—DURBAN.—May 15th. City Council. Turbo-generator sets, switchgear and Diesel-engined starting set (Contract W.45/US).

PIETERMARITZBURG.—May 7th. City Council. Cables (Contract 204); lamps (205); poles (206); fuse boxes (207); wire (208); switchgear (209); and transformers (210).

SALISBURY.—May 18th. City Council. Cable and conductors (Contract E.17).

BULAWAYO (S. RHODESIA). — May 20th. Municipality. Meter testing equipment (Contract E.13/1942).

KENHARDT.—June 24th. Municipality. Plant for electricity supply undertaking.

UPINGTON.—June 24th. Municipality. Electrical plant (alternator, switchboard, meters, crude-oil engine, etc.).

Orders Placed

Cheltenham.—Highways Committee. Accepted. Motor and starting gear for tin baling press (£134).—B.T.H. Co.

Newcastle-on-Tyne.—City Council. Accepted. Repairs to electric lighting installations in Council houses for the next six months (£190).—R. H. Patterson.

Southport.—Electricity Committee. Accepted. Mechanical coal shovel (£475).—Chaseside Engineering Co.

Worthing.—Electricity Committee. Contract renewed for 12 months. Paper insulated cables.—Britannic Electric Cable & Construction Co.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Alloa.—Business premises for Motherwell Bridge and Engineering Co.; manager.

Bootle.—Rest centres, &c. (£20,000); borough engineer.

Chester.—Out-patients' and casualty departments and extension to boiler house at Chester Royal Infirmary; board of management.

Essex.—A.R.P. depot at Harwich (£1,490) and cleansing centre at Waltham Cross (£890); county architect, Chelmsford.

Glasgow.—Bus station; W. Alexander & Sons, Ltd., Camelon.

Hindley.—Day nursery (£2,061); W. J. Bickerstaff & Sons, builders, Seven Stars Bridge, Wigan.

Hull.—Repairs; E. Ernest Keighley & Co.,

Repairs, King's Mill, Stoneferry; Benninga, Ltd.

Repairs, Hedon Road premises; Brigham & Cowan, Ltd.

Reconstruction, 93–9, Lime Street; J. F. Haller & Co.

Manchester.—Electric runway and block in cold stores; G. Noel Hill, city architect, Town Hall.

Newcastle-on-Tyne.—Soldering department for C. A. Parsons & Co., Ltd.; A. Anderson, Ltd., contractors, Stanmore Road.

Offices for C. A. Parsons, Shields Road; staff architect.

Boilerhouse extensions for R. & W. Hawthorn Leslie & Co. Ltd.

Additions for W. Findlay & Co. Ltd., engineers, Newcastle.

Northenden.—Extensions to works; W. Thorpe & Son, Ltd., builders, Chester Road, Cornbrook, Manchester,16.

Northumberland.—School canteens, extensions to canteens and reinstatement of schools; county architect, County Offices, Morpeth.

Canteens at collieries; Mauchlen & Weightman, 12, Saville Row, Newcastle-on-Tyne; Tasker & Child, Trinity Buildings, New Bridge Street, Newcastle-on-Tyne; and Cackett, Burns Dick, & McKellar, Ellison Place, Newcastle.

Sheffield.—Welfare centre, Darley Dale (£7,626); city architect.

South Shields.—Reinstatement of Laygate Lane School (£2,500); H. Hill, architect, Winchester Street, South Shields.

Stafford.—British Restaurant and cooking depot; Northern Steel Scaffolding Co., Ltd., Didsbury, Manchester,20.

Sunderland.—Conversion of Carlton House, Mowbray Road, into a youth centre (£1,500); three additional shelters at Plains Farm School; O. T. Mark, Education offices, Tatham Street.

Urmston.—Works extensions; architect, B. Waterhouse, 134, Deansgate, Manchester. Builders, R. Carlyle & Co., Ltd., Elsinore Road, Old Trafford.

West Hartlepool.—Shelters at the Technical College; F. Durkin, borough engineer.

Worksop.—Canteen at Firbeck Main Colliery, Carlton (A. Wilde, manager); Doncaster Amalgamated Collieries, Ltd., South Parade, Doncaster.

York.—Cleansing station at Hospital (£1,177); R. J. Pulleyn & Sons, builders, Grand Cinema Buildings, Clarence Street.